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CONTENTS

ILLUSTRATED:
Crosshead and Piston Rod Connection 565
Early History of the Delaware, Lackawanna & Western Railroad and Its Locomotives 566
The Royal Alexandra Bridge at Ottawa 568
The Pittsburgh Plant of the American Bridge Co., Near Economy, Pa 570

EDITORIAL:
The Economics of the Brake 572
Editorial Notes 572, 573

MISCELLANEOUS:
The Superintendent, the Conductor and the Engineman 563
The National Bureau of Standards 567
Frozen Train Pipes. Their Cause and Prevention 571
Train Despatchers' Convention 574
Oil Sprinkling on the Santa Fe 575
Crop Conditions on July 1 575
Chicago Freight Handlers Strike 575

GENERAL NEWS:
Technical 575
The Scrap Heap 576
Locomotive Building 577
Car Building 577
Bridge Building 577
Meetings and Announcements 578
Personal 578
Elections and Appointments 579
Railroad Construction 579
General Railroad News 580

The Superintendent, the Conductor and the Engineman.

BY B. B. ADAMS.

From one very practical point of view these three officers, or employees, or classes, are more important than any others in the railroad service. A railroad is nothing but a transportation machine; the movement of cars is the essential thing in railroad transportation; no cars are moved except by locomotives, and the man who controls the engine therefore performs a most vital function. The conductor is almost or quite equally important, because no one would think of requiring the engineman alone to perform all the duties of engineer, lookout, boss of brakemen and train clerk; the responsibilities are so multifarious that most superintendents would deem it too risky. And the superintendent is indispensable—to say nothing of his other duties—because the work of a dozen or a hundred conductors and enginemen must be harmonized, and new men must be instructed. So much for my title. My subject is the relation of these men to the collision record of the last accident bulletin of the Interstate Commerce Commission, from which it appears that in the three months ending with December, 1901, there were in the United States 27 disastrous butting collisions, involving a loss, not counting the damage paid for injuries to persons or for losses of merchandise in the cars, of $306,511. The number of persons killed in these collisions was 70, and the number injured 234. These totals, be it remembered, represent only the 27 worst cases. The total number of collisions of all kinds reported in the three months here spoken of was 1,481, and the damage to rolling stock, track, etc., was $1,399,813. The bulletin giving these figures, with other facts concerning the accidents of that quarter, was published in the *Railroad Gazette* of June 27.

This record is a great disgrace to the railroad profession of America. It is true that the number of passengers killed and injured, as compared with the number of persons who travel, is an extremely small percentage, and that any man is likely to travel in passenger cars scores of years before he will be even injured. It is probably true, also, that travel by railroad generally is increasing in safety year by year, owing to the widespread adoption of improved standards of construction of roadway, cars and engines. (Though the rapid increase in the size of freight cars and the transition from small cars to large, and from hand-brakes to air-brakes have doubtless temporarily checked this progress). And, having used the term "profession" I must also qualify my statement by recognizing the fact that the worst collisions have occurred on those roads where the professional spirit has had the least chance to assert itself. Moreover, the correction of deficiencies in the personnel—which deficiencies constitute the feature particularly demanding consideration in connection with butting collisions—constitutes the most difficult part of the problem under consideration, either for a professional railroad officer, or for any other kind.

But notwithstanding these considerations on the favorable side, our collision record is a great blot on a page otherwise fair. In England, where, on their 21,000 miles of busy lines, the whole passenger traffic of 1901—1,500 million passengers—was carried without a fatal injury to a single passenger by a train accident, our methods of railroading are soberly characterized by the savage term "reckless"; and we cannot with very good grace question our cousins' judgment, for the very great difference which one finds in the records of 1901, is not the only comparison of the kind that can be made; great differences between their records and ours have appeared in all the yearly totals, except perhaps those of 1879 and 1889, when the Tay bridge and the Armagh disasters occurred. And our own daily newspapers are constantly finding occasion to condemn the conduct of one railroad or another, as a shocking collision occurs here or there.

In many, if not all, other features of railroading the progress which has been made in the art of safety can be definitely marked, and the efforts which have been made to improve the service can be shown to have tangible results; but in the prevention of collisions we are unable (with the exception of a single feature, which will be referred to later) to point to any important improvement during the past dozen years. It might be said that this bad showing in the matter of collisions is in part due to the nature of the case; that even if the number of collisions is reduced, by the exercise of great care and ingenuity, there must remain the fact that single-track running is very hazardous, that a very small error may produce a very great horror, and that therefore no reduction in the number of collisions, even if it be 75 per cent., can be expected to improve the record in proportion to the energy or money expended; because a single collision may kill a hundred passengers. But this does not alter the fact that every serious collision of passenger trains distresses the superintendent on whose line it occurs, injures the reputation of the road, and costs the company a large sum of money. Do not these considerations warrant some further and more thorough study of the causes of collisions?

I refer to the Government record for the reason that the facts are official, and because statements of the losses are given; though the circumstances of the accidents are in no important respect different from those of cases in the same class which have been reported in the *Railroad Gazette*, month by month, for many years past. Moreover, I do not wish to appear as the critic of the particular roads on which these particular accidents occurred, for, as was recently remarked by a prominent railroad president, "all roads have them"; and what I have to say may with propriety be given a general application. The causes shown in the official record may be classified roughly as follows:

	Reference number.
(a) Despatcher's error	6, 14
(b) Operator neglected to deliver order	7, 13, 15, 36
(c) Operator wrote order incorrectly	4
Conductor or engineman, or both—	
(d) Disregarded rule of superiority of trains	34, 40
(e) Misread watches or miscalculated time	11, 38, 60
(f) Forgot or misread a written order	3, 17, 33, 57, 67
(g) Read register carelessly	16
(h) Misread time-table	5
(i) Neglected to identify a train that was met	37
(j) Engineman passed fixed signal without observing it	39
(k) Engineman "lost his bearings"	35

I introduce detailed notes of specific collisions solely for the purpose of making clear the importance of the subject. I do not propose to discuss the nature of the varied causes in this list, or the question of removing them, one by one (though I do propose to consider one remedy); for that would take 10 times too many words. Moreover, the causes have been much discussed already. The interested reader already has in his memory the causes of a score or a hundred collisions; and this article is not written for the purpose of rehearsing things thus already well known; but rather to ask some questions concerning the rules which are violated when collisions occur, with a view to seeing whether those rules can be better enforced. In short, the question is, must we continue to see published by the Government every three months a record of a thousand collisions, costing a million dollars, and killing a hundred persons, and feel compelled to offer nothing in explanation but the time-worn statement about the impossibility of controlling the personal equation? Are we to continue forever to assert that the rules are adequate and that the men are intelligent enough to understand them; that the men ought to do better because their own lives are at stake, if for no other reason, and that the railroads, never grudging any money expenditure, have done all they can? We ought to answer all these with a "no." To do so may take a long time and a good deal of money; but there is no question that at least an attempt to thus answer is a present duty.

I have said that the causes of butting collisions are too varied to be discussed here. Such a discussion would include consideration of forgetfulness on the part of conductors, enginemen, brakemen, and telegraph operators; mistakes in reading watches and time-tables and in subtracting and adding minutes and hours; effects of overwork and lack of sleep; improper lookout habits on the part of enginemen; defective work on the part of the officer who should teach or train these men: lack of a suitable age-limit or experience-limit in making appointments; wise or unwise policy in regard to punishments, and numerous other things. As before stated, these questions have been widely discussed; and almost any superintendent, trainmaster or despatcher will glibly give his views concerning them; but when we come to ask how extensively or how thoroughly these officers have applied their ideas to the actual instruction, warning or improvement of particular conductors, enginemen or operators, the answers are almost always unsatisfactory. It would seem that each superintendent has so few collisions on his own road, and has, or believes he has, so few men needing warning or instruction, that he deems radical action unnecessary. A disastrous collision happens on the A. & B. road to-day which is due to the same cause that figured on the X. & Y. road a year ago; but whether the superintendent of the A. & B. took any measures a year ago to give his men the benefit of the X. & Y. lesson, is a question that is very rarely answered. The prevention of collisions, of the kind we are now considering, involves the most fundamental elements in an engineman's or a conductor's training, and yet we give to the subject much less attention in the way of instruction and supervision than we give, for example to the air-brake, which, in comparison, may be called a detail.

While, therefore, it is probably out of the question to profitably discuss these very interesting questions of discipline without first carefully investigating the conduct of a dozen or a hundred trainmasters' offices—which I have not done—there is one question which I do believe it is worth while to take up, without regard to whether the superintendent, who reads this, is or is not satisfied with his freedom-from-collision record; and that is the question of inspection. All of these mistakes which I have rehearsed are violations of simple rules; rules that are easily understood; and the investigation of a collision almost always shows that the rule was or had been actually understood by the person making the mistake. This fact invites the inquiry whether conductors, enginemen and telegraph operators do not habitually relax necessary habits of vigilance. So many cases have occurred where a necessary habit had been neglected or a duty had been habitually performed in a way known to be short of perfect correctness that, for the purposes of the present discussion I am safe in answering this query in the affirmative. These men do neglect simple safeguards every day. The safeguards are prescribed by the superintendent, and to omit them is a definite offense. Why is not this negligence prevented, or, at least, more effectually mitigated? Do superintendents make no attempt to cure it? Or do they try to stop it, and fail in the attempt?

There appears to be ample ground for the broad assertion that on very many railroads the inspection of the work of conductors and enginemen, and, indeed, of all classes in the train and station service, is done with but little system, often with none at all, and is very deficient in many respects. It may be answered that this is true, but that the fact has no force, for the reason that more thorough inspection is not necessary. The high character and intelligence of the men, the simplicity of their duties, and the universal prevalence of the rule to employ only men who have learned at the school of experience, justify the superintendent in telling the men what to do and then trusting them to do it. But this is just the point that I wish to combat. I can only make a beginning, but at least a beginning is, I believe, urgently necessary. A traveling salesman may be trusted for a year, or 10 years, without inspecting his work; results are the only measure of his efficiency. An evangelist sent into Africa or Alaska, or a reporter sent to crawl into the crater of Mont Pelee, could hardly be made more efficient by inspection. But there is no excuse for not inspecting train work, except evidence that inspection would be impossible or would cost more than it is worth. I believe that the assumption that this last is true is a very common assumption; and that it is wrong.

What do we do in the way of inspection? Conductors are watched for the detection of dishonesty. Probably not enough of this is done, but the question is of only minor consequence here because an honest conductor is probably as likely to cause a collision as a dishonest one. (Though it may be said, in passing, that inspection of a conductor's work in one line often spurs him to greater efficiency in other lines.) Road foremen inspect the work of enginemen. This is the most useful inspection we have; but many roads have too few road-foremen, and nearly or quite all of these men devote their chief attention to questions of economy, the use of fuel, and mechanical matters, leaving signals, train orders, time-tables and lookout to take a secondary place. Instruction in air-brake practice is now quite general, and this involves, to a considerable extent, useful criticism on the past practice of the men instructed; but this can hardly be called inspection; and air-brake practice is not one of the chief topics in a discussion of butting collisions.

Some few roads have inspectors who visit telegraph and signal stations with considerable frequency; and some have all train orders sent in and looked over by the chief despatcher or other critic, but it does not appear that many have made use of this laborious but necessary check on the work of their operators. All efficient superintendents examine with care into the ability, habits and general conduct of any of their employees who happen to make a blunder which necessitates an investigation and reprimand or discipline; and some take pains to see that the lessons of an accident-investigation shall be promulgated for the benefit of other trainmen; but these bulletin lessons are usually very brief and there is no assurance as to how many of the men who read them actually reflect on them. Many trainmasters "make it their business to be out on the road as much as they can"; but many do not do so; and often this phrase means but very little. At best the trainmaster does this work unsystematically, and usually it is secondary to other duties which press upon his time more constantly.

This short statement covers about all that is ordinarily done in the way of inspection; and a good deal of this work here described is not inspection at all. Conductors and enginemen are jointly responsible for the safety of the train which is placed in their charge; but if one is negligent, leaving important duties to be performed by the other alone, no one ever reports the fact to the superintendent. Conductors must show their train orders to the flagman; but from not appreciating the importance of such a check, or from the flagman's ignorance, this

often falls short of being an adequate safeguard. The same applies to enginemen and firemen, with the added difficulty that the combination of an overbearing superior with a timid or ignorant inferior seems to occur oftener on the engine than at the rear of the train. The rule requiring enginemen and firemen to communicate with each other on sighting fixed signals is claimed to be on most engines a dead letter. Whether there is or is not a rule of this kind in effect on a given road, an engineman who disregards the indication of an automatic signal usually goes undetected. It appears quite certain also that many cases of disobedience of fixed signals near signal cabins go unreported because the signalman, from good or bad motives, omits to inform the superintendent of the fact. Many signalmen, as well as telegraph operators, are young, with moral characters not sufficiently developed to give them the necessary courage to report a fellow employee's delinquency.

A skillful lawyer could make a good argument in support of the assertion that we do not try very hard to find out whether our trainmen obey their instructions. Fifteen or 20 years ago, when the diversity and inconsistency of our train rules was under discussion, a prominent superintendent, who has since risen to a much higher managing position, said to the writer, in substance, that the proposal to make a standard code was not of great importance; the trouble was not in the rules but in getting men to obey them. He might to-day plausibly claim that he was right; that if the energy which has been put into improvements in phraseology on paper, had been devoted to the more direct application to enginemen's ears of some of the old-fashioned phraseology that was already available, the results would have been better.

Some roads have "schools" for instructing their trainmen in the rules. Since the introduction of the Standard Code this feature of the service has been made the instrument of much good. But schools for informing the men what the rules mean, do not help us at all in finding out whether the men will carry out the rules after they know them. The schools have clarified and increased the men's knowledge, but we cannot be sure of any improvement, from this source, in mental habit or in conscience. A man's conscience and disposition—his moral character—greatly affect his trustworthiness; that is, they have a bearing on the likelihood that he will perform all of his duties with regularity and freedom from blunder. Why, therefore, should we not make such tests as may be necessary to give some knowledge of the men's consciences and disposition?

Now, is it practicable to watch all these men so as to know just how they conduct themselves; and if it is practicable, will it pay? Taking the last part of the question first, there would seem to be no question that expenditures for perfecting the conduct of conductors and enginemen in the management of trains would be as justifiable as those, for example, which are constantly made for testing the honesty of train conductors and the efficiency and honesty of sleeping car conductors and porters. The prevention of a collision means preservation of life and the saving of large sums of money; and it also means the strengthening of the reputation of a railroad. The prevention of irregularities in cash and ticket collections merely means a small money saving; the enforcement of neatness and promptness among porters, or of politeness in any class, has to do only with the convenience of passengers; but prevention of collisions affects their lives and essential elements of their happiness. From the standpoint of the thoughtful passenger it must seem utterly ridiculous to constantly watch trainmen to see if their shoes are blacked and their faces shaved, while taking no measures to see whether men charged with the safety of passengers' lives are not daily disobeying some vital rule.

If the pay rolls of conductors and enginemen were increased, for the purpose of providing an adequate force of inspectors, by as large a percentage as the Pullman Company's pay rolls are thus increased, an immediate and definite improvement could be made in the service. Does any one doubt this? It seems to me that it is self-evident, requiring no demonstration. At all events the Pullman superintendents have systematic records which afford them ground for a definite opinion as to the trustworthiness and efficiency of their men, whereas most railroad superintendents have very fragmentary records, or none at all. Every railroad superintendent knows that in important features the discipline of the Pullman men is far above that of railroad trainmen. Many railroad superintendents, by long acquaintance, know some of their men very well; but it is a matter of personal memory, not an official record. Is not a record worth having? An addition of 3 per cent. to the sum paid monthly to conductors and rear-brakemen would on most roads afford an inspection of the work of these two classes which would be far ahead of anything that has ever been done, except in a spasmodic way. Even 1 per cent. expended in that way would produce tangible results. Can any one doubt the wisdom of spending a similar percentage also on enginemen and firemen? Or, if doubts exist, can they be attributed to any other source than the narrow purpose of always keeping your expenses down to a certain percentage of the gross receipts? By inspection of enginemen and firemen I mean inspection of those things which road foremen, as now instructed, usually have to neglect or to treat as of secondary importance. In many cases the doubling or trebling of the number of road foremen would make the difference between poor service and good. Inspection of telegraph operators and other classes will produce benefits as definite as in the case of conductors' and enginemen; though the results will seemingly be less important because there are fewer operators, and also because their work is less complicated and is already better supervised.

To settle the question whether or not certain measures for the safety of trains will pay, one must have a standard of excellence of service, and be guided by the degree of success with which that standard is attained; for the other side of the account—the aggregate of losses from collisions—is good for nothing for comparison unless we can take the totals for 10 or 20 years, including some of the future; and that is out of the question. The best assurance you can have for the future is that your men have been properly taught and are practicing what they have been taught. Having that assurance, and the assurance that the rules are clear and the men clear headed, your conscience need not be disturbed even if collisions do occur. How many superintendents have that assurance to-day? Any one who feels that he lacks it in a serious degree is bound to consider that the true standard of excellence of service—that is, the standard of safety—is not yet attained. The standard being unattained, he is bound to approve and order any practicable expenditure that may be necessary to attain it. The only reasonable alternative to this is to reduce the speed of all trains to a very low rate. One can never satisfy himself by aiming at anything lower than perfection, for the reason that there is no guide as to how far below perfection the mark should be set; and, also, because even with the best attainable we shall still be below the ideal. This may seem to be a very trite observation; but our collision-record has become exceedingly trite; so trite that we are blind to its horrors.

As to the practicability of this inspection, there should be little question, for any superintendent can learn by the example of others, if he thinks he needs to learn. Concrete examples are to be found here and there, if one will look around a little. Not every kind of negligence and inefficiency can be ferreted out in a day, or in a month; neither can every inspector's work be proved to be valuable at the first trial; but perseverance will settle these difficulties. The first point to settle is whether any given inspection shall be open or secret. Superintendents who have been most successful in managing their men have employed both kinds. Secret inspection, or, rather, "surprise checking," as the English call it, is as reasonable in connection with train-running as with cash-collecting. Why not? In either case it is no discredit to the employees whose conduct is already unobjectionable, any more than the government bank-examiner's visit is discreditable to an upright bank president. But the superintendent who wants to employ secret inspectors often finds it difficult to get trustworthy and competent men; and he cannot keep them long in one district. Therefore it is desirable to have the regular inspectors do everything in this line that they possibly can. If the regular inspector is the right kind of man he can do a good deal of semi-secret work himself. The superintendent should plainly tell the conductors and enginemen that they are constantly liable to be surprised; and then see that they are surprised. I need not say that only an inspector of good character, first-class judgment and ample tact is fit for this work.

Surprise checking is needed to test observance of all those rules which have to be carried out where nobody is looking; and the presence of a brakeman with a conductor, or of a fireman with an engineman does not remove this necessity, for a subordinate is usually reluctant to report, or even to advise, a superior.

Examples of some of the things needed are readily suggested by the list of causes which I have already given. Take the most numerous class, forgetting or misreading a train order. In this detail "surprise checking" means the use of orders designedly made wrong or irregular, and a repetition of such a test until the habits of the man tested are found out. In many kinds of clerical work it is universal experience that ability to watch for errors is acquired only by dealing with a large number of actual errors; the expert clerk is the one that has had some hard experience. He has learned in the proverbial dear school. Why should the conductor and engineman, with their gravely delicate duties, escape this schooling? Errors, of the kind we are now considering, occur so infrequently that potential errors must be manufactured for them. A conductor who will neglect to stop his engineman at a meeting point—the error that is said to have been made at Seneca, Mich.—must be tested by fictitious meeting orders, the engineman co-operating in the testing. An engineman who (under the Chicago & Alton rule, requiring the conductor to first signal the engineman) neglects to take the initiative in stopping at a meeting point, depending on the conductor to act first, must be called to account for keeping on steam for a single rod beyond the point where the conductor (designedly) neglects to act.

Careless reading of registers is to be cured by calling conductors and enginemen to account for neglecting to report cases where entries on the register are not entirely clear, or where such entries vary in even minor details from the requirements of the rules. Designedly irregular entries must be employed for this purpose as often as may be necessary.

Misreading time-tables is a more obscure difficulty. Practice in a "school," in picking out facts quickly, without error, by which practice a man can learn the nature of his own faults or deficiencies in this respect, would be highly useful. Repeated study of time-tables for a half hour at a time, guided by judicious questions, would be valuable training for a large portion of the enginemen on any road. As a diversion it would not be so attractive to the enginemen as an exercise in formulating train orders, or a discussion in which the despatcher could be criticized, but it might bring more valuable results. One man will use a pencil to guide his eye down the column, in reading a time-table, and another will not. So trifling a difference as this may make the difference between error and correctness; and will any one say that it is too trifling a point to receive attention in educating your men? In any work in which surprise tests cannot be made to really expose the chances of error, the appropriate safeguard is to give men such frequent drills that they can themselves more fully realize the danger of making mistakes. If they are conscientious, this knowledge will lead them to try to adopt better routine habits. If they are not conscientious they should not be entrusted with a train.

Neglecting to identify a train that is met has caused some very bad collisions. Does any superintendent doubt that the carelessness which leads to this class of errors could be greatly lessened, if not entirely cured, by testing the men's vigilance occasionally? One prominent Western road requires the men of each train to exchange identifications by word of mouth. At first thought this would seem to be an extreme requirement, involving delay if always obeyed, and leading to looseness of discipline if not strictly carried out; but an officer of that road states that the rule *is* enforced and that its working is and has been satisfactory. It has been in force many years and it has accomplished the purpose aimed at. Is not every superintendent bound to adopt and enforce a rule of this kind, unless he has something that can be shown to be better? Identification by word of mouth (or by any other positive method) necessitates a regular and correct habit on the part of every conductor and engineman. The detection of laxness in this habit is not difficult.

After non-identification, the next thing in the list is "passing fixed signal without observing it." This brings up the question of enginemen and firemen shouting to each other at all fixed signals. The rule requiring this is now widely adopted and seems to be looked upon as a useful safeguard; and yet one of the most successful superintendents that I know says that he will not have such a rule. He calls it a dangerous division of responsibility. Moreover, there is evidence that the rule is often ignored, or at least is not strictly obeyed. The reader will recall recent discussions on this subject in the *Railroad Gazette*. I do not propose to re-open the question here, for my subject is not the making of rules, but their enforcement. Whichever view a superintendent may take as to monitorship by firemen, he is bound to see that the rule that he does adopt is not constantly ignored. If the shouting rule is prescribed, obedience to it must be looked upon as a necessity. If slipshod habits cannot be cured without sending road foremen over the road 10 times oftener than heretofore, then that is what is required. Is there any escape from the logic of this argument? Even if a detective fireman has to be put on to test a refractory engineman now and then, the superintendent who determines to enforce his rule must not flinch. The only rational alternative is to revoke the rule.

To explain a collision by saying that an engineman "lost his bearings" does not really explain. There is no true and precise statement of just what the real cause was. Hence this alleged cause need not be considered here. The other causes which I have not considered may also be passed over, for my purpose is not to comprehensively discuss all of the causes of collisions that can be thought of: it is merely to cite a sufficient number or variety to illustrate my argument.

But perhaps I am wasting good paper and misusing the reader's time in going into details even to the limited extent that I have. It cannot be that any superintendent is in much doubt as to what defects of practice to look for, or in any perplexity about methods. The question is, shall there be any inspection at all for the correction of those classes of errors which figure in the collision record? The irregular observations which a superintendent or a trainmaster can make during his trips over the road, valuable as they are in many individual cases, cannot reasonably be termed inspections in any proper sense; and the inspections of road foremen are insufficient, for two reasons: first, they do not reach the conductor at all, and, second, the road foreman devotes his chief energies to mechanics and fuel. So the question is, should there be one, two, six or a dozen men on a division who should devote their chief attention to promoting strict observance of the train rules?

I have asked this question, and the preceding ones leading up to it, not for the purpose of answering them off-hand; but because it seemed worth while simply to formulate the questions. Even if they do not get answered they deserve consideration, by reason of the importance of the subject. It is for each superintendent to answer them for himself. For my own part I want simply to record the fact, which does not seem to be well enough known, that one prominent railroad manager in the West does maintain a *regular* inspection of the conduct of his enginemen in the observance of fixed signals. Regularity is the point that I wish to emphasize. Enforcing obedience to semaphores cannot prevent all butting collisions; but I give prominence to this example because it supports the general principle of surprise checking. The manager referred to does not employ inspectors to inspect and do nothing else; but he does avoid the weakness which results from making an important duty secondary to some other duty, by requiring that inspections be made with sufficient frequency to supply a re-

port for his own use every month. Division officers have tests made all the time—that is to say, they are being made every week; but they are reported to the general headquarters only once a month. Tests are made by the train despatchers, who go over the road for this purpose and for the purpose of keeping posted in regard to changes; by the chief despatcher, the trainmaster, the assistant superintendent and the superintendent himself. Road foremen of engines, and some of the men in the signal department are also employed to some extent. Enginemen know that they are tested, but they do not know who does it. The most usual test is to put a certain signal in the stop position at an unexpected time or place and see whether it is obeyed. The frequency of the tests depends somewhat on the density of the traffic. Each report gives all particulars of place, time, train, and names of men. The inspectors also watch the speed of trains and note whether enginemen use too much space to stop a train in; and they report on any detail of practice that may need correction.

The one thing that seems to act as the most constant deterrent with superintendents who are disposed to watch their men is that after a time the worst faults seem to be cured, and inspection appears to be no longer necessary. But, in the language of an experienced manager and president "the element of carelessness is always creeping into the service"; and the only antidote to this is the maintenance of a constant fight against it. Moreover, the superintendent has no guide by which to train his second-best men up to the standard of the best, unless the efficiency of all is frequently measured. You impair the efficiency of your inspectors if you let them drop the work and do something else for months at a time. Inspectors can find enough to do, if they have the authority. There should be inspectors independent of the trainmaster, to see that he is not too easy in putting "slow" men, or men of insufficient experience, on important trains. Many collisions have resulted from assigning a man to a job with which he is not familiar, or concerning which his knowledge, formerly good, has become rusty, without seeing that he brushes up his knowledge. Conductors and enginemen are constantly tempted to entrust to a subordinate, or to tacitly allow a subordinate to perform, an act which the rules require them to attend to personally. This matter needs constant watching. Looseness in allowing incompetent persons to temporarily perform important duties is common in telegraph offices. "Incompetent" seems a harsh word to employ in this connection, and in many cases its applicability is not positive, but only presumptive; but when a collision does occur in consequence of the absence of an operator from his office for half a day, the full force of the term appears.

At the beginning I set out to discuss the duties of "the superintendent, the conductor and the engineman"; but I have given the larger share of my attention to the conductor and engineman. The superintendent, however, will not complain of any neglect of his part of the case, for I have addressed myself chiefly to him. As a final word I may perhaps venture to caution him not to expect to be able to introduce additional safeguards without disturbing anything. Every good thing costs something, and good discipline is no exception. I am not now speaking of the money expenditure, but of changes in the service. We do not get the benefit of the air-brake without spending valuable time in tests and inspection of apparatus. We cannot have a large force of good men constantly available without spending much time and effort in the management of a separate class of men in a condition of apprenticeship. Obedience to signals cannot be insured without sometimes delaying trains. Men cannot be kept reasonably vigilant without sometimes requiring what seems to be excessive caution. One road in the West requires freight trains (and many other trains) on single track to get a clearance or a train order from *every telegraph office*. (There are exceptions to the rule, and it does not apply where the block system is in force; still it is a much-used rule.) Such a rule is a definite safeguard and has, no doubt, prevented collisions; but it costs some time and money, and much care. I do not here discuss the merits of the rule, but simply cite it as an example of securing safety at the cost of some inconvenience.

I have said that our safeguards against butting collisions have not lately been improved except in one particular. That exception is the spread of the block system. Many roads have adopted the space-interval on single track lines, and, of course, without any additional expense, they provide against butting as well as against rear collisions. There can be no question that the adoption of this system has prevented many butting collisions, though no records are available. Some managers have made comparisons of a series of years before the change, with other years after it, showing a marked and gratifying result; but this is a kind of record that is not often allowed to be published. It is also to be said that the money-saving is probably much larger in the item of rear collisions than in butting; but the comparisons usually lump the two together. No one, however, doubts the main fact. The block system is a great safeguard because it takes from the conductors and enginemen the responsibility of reading time-tables, adding and subtracting minutes, deciphering poorly written telegrams, carrying out flagging regulations and studying partially understood rules on various points, and substitutes for this a force of signalmen, situated at fixed points and making the safety of trains their chief and often their only duty. The block system greatly increases safety even if there be no improvement in the men or in their discipline. The reader will recall a recent instance where a railroad company which suffered a great loss by a butting collision, soon afterward ordered the adoption of the block system on several hundred miles of single track line.

But the block system does not make discipline unnecessary, and in recognizing the great value of the principle, and the enterprise of the railroad companies that have adopted it, I do not mean to modify anything that I have said concerning the importance of inspection, and the need of improvement in discipline in every direction where improvement is possible. If the manual block system is used there is need of a high mental and moral standard in the signalman. An age-limit and an experience-limit should be rigidly maintained, and a regular signal man should not be off duty a single minute without putting in his place a substitute whose competency has been as thoroughly tested as that of the regular man himself. There has been a good deal of evidence that railroads of pretty high reputation have employed and do employ signalmen who lack either years or experience, and sometimes both. The term "experience" when used of the incumbent of an important railroad position should mean, not merely a number of years engaged in a certain kind of work, but a term spent in such work under surveillance, and of which there has been periodical examination or record. One man acquires as much knowledge by one year's experience as another does in three years. This difference should be a matter of precise record, not merely the personal impression of the superintendent or trainmaster.

With automatic block signaling (and, to a less extent, with manual signals also) there is need of the "surprise checking" already alluded to. With or without the block system, a great improvement in inspection is necessary in the American railroad service to bring it up to a reasonable standard of safety. As mentioned in a foregoing paragraph, the railroads of England make a record far and away beyond ours, as regards the security of both passengers and trainmen. The railroads of America could almost take lessons, in the matter of safety from accident, from a powder mill. At Ardeer, Scotland, there is a nitro-glycerine factory, employing 1,300 persons, and making 100 tons of explosives weekly, where, according to a writer in *McClure's Magazine*, the number of fatal accidents in 25 years has been only 21, or less than one in 1,300 yearly. It would be mortifying to compare this record with the fatal accidents to the trainmen of our railroads. This almost incredible record is attributed mainly to "the admirable character of the discipline imposed and the firm and careful system of management"; though rigid inspection by the government is also mentioned. Evidently the proprietors of this factory do *not* follow the method which one American railroad president confessed had been followed on his road, that of adopting well-known safeguards immediately *after* a disaster (collision) had called attention to the need of them. The number of employees at Ardeer is 1,300. If 1,300 American freight trainmen were to be employed in a territory as small as the few hundred acres occupied by the nitro-glycerine works; and if they were to be killed and injured as rapidly as they are at present, the public would be so shocked that heroic measures for their safety would be forced without delay—through government action, or in some way. But, of course, the desirability and importance of remedial measures would not be a whit greater than is the case now.

Herbert Spencer, in one of his recent essays says, "Do not suppose things are going right till it is proved they are going wrong, but rather suppose they are going wrong till it is proved they are going right." This he terms a "Business Principle." The adoption of this business principle in the management of train movements will reduce the frequency of the occasions on which it is necessary to comply with the legal principle, now being vigorously applied everywhere, that a railroad must pay from $50,000 to $500,000 to victims, lawyers and others, every time it has a big collision. This is a pretty sound principle, but men call it sound because they base it largely on the belief that it is a powerful incentive to the adoption of preventive measures; and every railroad officer is justified in doing all he can to make the principle a dead letter by abolishing the occasions for its application.

NEW YORK CITY.

Crosshead and Piston Rod Connection.

BY ROGER ATKINSON.

There are a number of mechanical difficulties connected with the maintenance of locomotives which appear to stand out in greater prominence with the passage of time, and any one having charge of locomotive repairs could, without taking much time to think, make out a list of the principal items on a general repair sheet. One of the less prominent ones is the subject of this article. The magnitude of the legitimate strains transmitted (to say nothing of those which are unexpected), together with the frequency of reversal and repetition, have brought it to the front by reason of the failures induced. Some designers have been disposed to consider that the increased size of locomotives during the past 15 years is partly the cause, but, from the writer's experience, such is not the case. So long as the 17 in. x 24 in. eight-wheel engine with four-bar guides was the standard engine, and did the larger part of the heavy main line work, there were broken piston rods literally by dozens, but when they were replaced in the heavier classes of service by larger engines, there was not quite so much trouble. The principal point of failure was, of course, through the cotter hole. That this is so should not be any surprise, if we carefully consider the subject. It was the practice at one time to make the taper fit as good as possible, and leave a shoulder on the rod at A, Fig 1, to be drawn up against the crosshead when the key was driven hard. This system is based upon the supposition that a competent workman could so judge the fit that the shoulder would just come up tight at the time that the taper was also drawn as tight as possible. This is an obvious fallacy. The variation in material alone, without considering men and conditions, would render it impossible; and without enumerating the difficulties introduced by repeating the operation when under repair. The natural consequence was that either the shoulder was tight and the taper fit loose, or vice versa. If the shoulder was tight then the key soon stretched the sides of the key-hole in the rod, until the point of the taper drove hard, and the root was slack, which soon ended in the shoulder being slack also, by strains of alignment, and the final failure across the key-hole. An improvement was made by discarding the shoulder fit, turning it clear of the

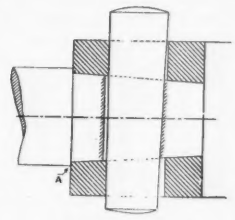


Fig. 1.

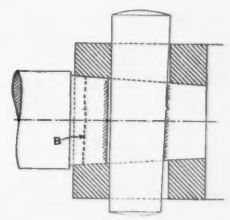


Fig. 2.

crosshead, and the taper fit was made as perfect as possible by grinding it in place. This succeeded reasonably well, and in consequence it was found that all the failures did not take place through the key-hole, although the majority did; still there was a percentage of failures through the solid metal of the rod near the front end of the taper, thus, as shown at B by a dotted line, Fig. 2. The comparatively large proportion which still failed through the key-hole is not to be wondered at, when the relative area of the cross sections are considered. On the other hand, it shows that the strain was more equally distributed. Eventually the shoulder was dispensed with altogether and the taper end enlarged. There has been introduced within a few years, the practice of keying the end of the taper against the bottom of the socket, thus, Fig. 3. This appears to be a return to the original conditions, viz., an attempt to make the rod tight on the bottom just at the same time that the taper fit is most perfect, which is, to say the least, impracticable, and it does not provide against the fore part of the taper coming loose by the stretching of the reduced section through the hole.

Judging from a long experience, one is led to the conclusion that more piston rods are broken by strains due to defective alignment than from any other cause, and

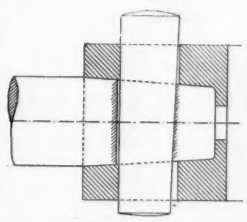


Fig. 3.

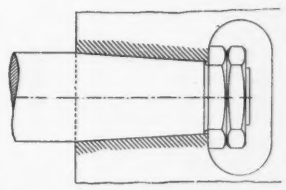


Fig. 4.

the above method of fastening gives such strains full play.

We have next the marine type, or taper and nut, which is perhaps only applicable to the open bar type of crosshead, Fig. 4, which forms a comparatively small proportion of the locomotives in service. In order to adapt this style of fastening to locomotives, the distance from the center of the wrist pin to the front of crosshead is usually increased, and the length of the taper fit is decreased and made as small as possible, both of which are detrimental as giving more effect to strains of bad alignment. Two nuts, both thin, and no key behind them, are also very inefficient; in fact, in all designing, experience shows that nuts are not to be compared for efficiency and durability with a check or a key.

It is evident to any one who studies the subject that the common method of securing the rod by a key through the center, and especially when the key is vertical, has very greatly weakened it, not only by having taken out 25 per cent. to 30 per cent. of the section, but the shape of the section left, shown in Fig. 5, is very badly distributed to withstand bending strains acting vertically, as the neutral line, A B, passes through the heaviest part of the section. We therefore find on inspecting broken rods, that the failure has almost invariably started at one of the sharp corners, top or bottom, as shown by crossed section lines. From this point of view, it would weaken the rod less if the key were put through horizontally.

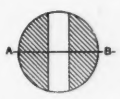
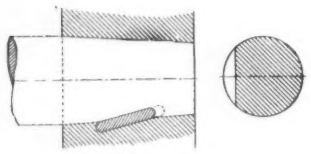


Fig. 5.

There is another defect frequently met with, viz., a badly fitting key. This may be due to the hole in the rod not being properly filed, and the key bears on top or bottom of the slot, or it may bear in the middle, and

result in a bent key. The point of strain then, may be changed whenever the key is refitted.

In order to overcome or avoid the greatest difficulties and retain the corresponding advantages, the writer would suggest the use of the side key as used in piston rods for steam hammers, Fig. 6, especially if it can be put in vertically or nearly so. This method reduces the section of the rod by the smallest possible amount, and in the least injurious direction, as it leaves the section, as in Fig. 7, full in depth and symmetrical about the horizontal neutral axis; the shearing area of the key extends through its full diagonal width from front to back, and as the center of the key bears against the solid metal of the crosshead in front, it is impossible to get a bent key. This arrangement has another advantage, which is that the side pressure due to the angularity of the key tends to hold the taper of the rod in hard contact with the full length of the opposite side and thus preserve the alignment of the rod with the crosshead. This system of attachment can be applied to locomotives now in service without great difficulty.



Figs. 6 and 7.

Early History of the Delaware, Lackawanna & Western Railroad and Its Locomotives.*

BY HERBERT T. WALKER.

PART VIII.—SOUTHERN DIVISION DIFFICULTIES.

When Watts Cooke was appointed master mechanic, he found the "Spitfire" on a side track, and after doing some necessary repairs put the engine to work hauling rails from the Lackawanna Iron & Coal Co.'s mills to the yard in Scranton ready to be sent out on the Southern Division, then under construction. Before dismissing this tenacious locomotive we will record the rest of its history as far as possible. Mr. Sydney Broadbent reports that in 1855 this engine was shunting and making up trains in the Scranton yards. In the following year, Superintendent Dotterer used it as an observation engine, the coupling rods then being removed. It was then (1856) "laid up in ordinary," and in the year 1859 it was taken from a side track and sold to the Spencer Coal Co., near Dunmore, Pa., and did service there until 1870-80, the coupling rods being replaced and link motion added. In 1893 the boiler was in use at Spencer's Rolling Mill, Green Ridge. These latter reports cannot be confirmed, but assuming they are correct and the engine traveled on rails until 1880, it was in active service for full 40 years, which is a good record. With the 109,268 miles it covered on the Reading Railroad added to its mileage as far as recorded on the Lackawanna Railroad, namely, 11,195, which does not include shunting and construction work, we have a total of 120,463 miles. So that with the work it did after leaving the Company's service, we may safely credit this engine with 150,000 miles.

In the year 1854 one derrick and one wreck car were placed in service, and the company were thus better equipped for dealing with accidents than hitherto.

The winter of 1854-55 was exceptionally severe and brought all operations on the Southern Division to a standstill. The price of labor and provender also reached an unprecedented figure. Contractors became disheartened and many refused to go on unless the railroad company made a substantial advance in prices. This was done to a reasonable extent, but the contractors were not satisfied and began to threaten that unless all losses were made good in full they would retain possession of the road by force of arms. Nor was this merely a threat, for they proceeded to arm their men and build block houses and fortifications across the track. The local authorities and citizens also joined them in resisting the company, and a very serious state of affairs quickly developed. In most of the cases, however, the company made settlements upon terms of great sacrifice, for the sake of peace, and work was resumed after this exasperating and expensive delay.

We will now examine the engine "Lehigh," illustrated in Figs. 19 and 20. Contradictory accounts have been given of this engine, but the weight of evidence goes to show that when the "Tobyhanna" was delivered and during the construction of the "Lehigh," Colburn retired from the New Jersey Locomotive Works, and the latter engine was not completed as he designed it. The original design will be found in Colburn's "Locomotive Engineering and Mechanism of Railways," page 83, where it will be seen that he followed Ross Winans' design very closely, but the fire-box was *wide* as well as long, which would give an excessive overhanging weight. This may have been one reason why the builders changed the construction after Colburn left them. However this may have been, Fig. 19 shows the engine as it appeared when received by the D., L. & W. R. R. Co. The frames, pump gear and draft rigging were similar to the "Anthracite" but the engine was heavier and more powerful than its precursor. The cylinders were 18 in. diameter by 24 in. stroke. Wheels 48 in. diameter. Colburn intended the inside fire-box to be 6 ft. long, but it was made only 4 ft. 6 in. by the builders. Its width, however, was retained, namely, 7 ft. 6 in. inside. There was a combustion chamber 4 ft. long at the fire-box end of the tubes. The throttle lever was on the boiler head and a rod ran from it into the cab, where it was connected to a hand lever. The advantage of this arrangement is not apparent, and it was changed back to Colburn's original design. The grate area was 33.55 sq. ft. and the tube surface was 1,008 sq. ft. The weight of the engine was about 62,000 lbs., a considerable portion of it being at the front end, as Colburn states that the weight of each cylinder casting was 19½ cwts., while a cast-iron "crypt" to the walls of which the cylinders were fastened with great strength, weighed 14 cwt. The cross section of the "Lehigh" shown in Fig. 20 will give a good idea of how these early wide fire-box engines looked on the 6 ft. gage.

In regard to fire-boxes of greater width than the track gage, it may be remarked that Colburn built engines of this design as far back as 1852, as described on page 84 of his "Locomotive Engineering and Mechanism of Railways," but he was willing to concede a prior claim to others, for he had been informed that an engine of this class, known as the "Mangle," had been built at Wolverton still earlier. It is evident he had not seen this engine, for a drawing of it, published in *The Locomotive Magazine* (London) 1897, page 18, shows it to have been one of J. E. McConnell's locomotives (nick-named "Mac's Mangle") built at the Wolverton shops in 1849 for the London & North Western Railway, and, whilst the fire-box was behind the driving wheels, it was contained wholly within the frames, in accord with the usual English practice.

As far as can be ascertained, the frames of the Winans "Camel" engines stopped at the front of the fire-box, but the latter was within the track gage. Millholland's "Pawnee" engines, introduced in 1852, had the frames and fire-boxes arranged in the same way as the Winans engines, and it was not until 1855 that Millholland produced the engine "Juniatta" with a fire-box of increased width, as illustrated in *Locomotive Engineering*, July, 1899, page 312.

The "Anthracite" and "Lehigh" were under construction at the same period (1854) but, as the designer of the latter engine had built wide fire-boxes two years earlier, the degree of width of the former engine's fire-box is unimportant, and therefore Colburn is apparently entitled to the credit of this design.

The wide fire-box, located entirely above the wheels, as we have it to-day, was not put into practice until 1877, when the first Wootten boiler was built by the Philadelphia & Reading Railroad Co. Wootten's earliest patent for this fire-box is dated July 3, 1877.

Mr. Henry F. Colvin, who did much in the way of testing new engines and superintending alterations, under the direction of Watts Cooke, states that the "Lehigh" was a poor steamer, and in 1856 the fire-box was lengthened to 6 ft., giving a grate area of 45 sq. ft., which brought it up to about the same dimensions as originally designed by Colburn. This and other additions increased the weight of the engine to 80,000 lbs., making it the heaviest locomotive then on the Lackawanna Railroad. In this altered state the engine steamed better and Mr. Colvin has hauled 84 empty cars from Sprague ville to Pocono Summit (78 ft. to the mile) with this engine, the usual load being 52 empty cars, but with the overhanging fire-box and short wheel base (11 ft.) it was unsteady and hard on the track.

Five other engines of the "Lehigh" pattern were purchased of the New Jersey Locomotive Works during the first half of the year 1856. Their names were "New York," "Drake Mills," "Pennsylvania," "California" and "Oregon." They all had their fire-boxes lengthened to 5 ft. 6 in. about the year 1858. About that time the "California" exploded at Sprague ville, killing the engine driver, Ed. Hawley.

Watts Cooke then rebuilt the "Lehigh" as a 10-wheeler, in 1862, with a long fire-box, with the back axle carried under it, and all the other engines of this lot were similarly changed before they were scrapped.

In the year 1855 Watts Cooke made some changes to the engine "Ithaca," reducing the diameter of the driving wheels to 5 ft., thus increasing its tractive power. One day, about this period, Mr. Cooke was riding on this engine in the Scranton yards. He was standing on the outside frame, watching the suspended link motion. Fortunately the engine was not going fast, for it collided with the "Keystone," and Mr. Cooke, jumping off to save himself, struck a post, which rebounded him towards the track, and the tender wheels of the "Ithaca" ran over his right arm, which had to be amputated. The engine men, who stayed on the engine, were not hurt. The "Ithaca" did service for many years, hauling the accommodation train between Stroudsburg and New Hampton Junction.

In the year 1855 the company obtained control of the Cayuga & Susquehanna Railroad, as previously recorded. The intention was to make Owego the terminus instead of Great Bend, but as favorable arrangements were made with the Erie Railroad Company for the use of their tracks, the idea was abandoned. The cost of running the engines for this year was reduced to $6\frac{56}{100}$ cents per mile as against $7\frac{72}{100}$ cents for the previous year. In this year also the engine "Pioneer" was converted into a stationary engine to pump water from the well at Scranton. It is worth knowing that the eight-wheel freight cars of this period carried but 10 to 12 tons of load.

After the "Lehigh" came on the road, several wood burners were purchased, among them being the "Kittatinny," in September, 1855. This engine was built by Rogers, Ketchum & Grosvenor, and is illustrated in Fig. 21—the wheels being removed to show the pumps and valve gear. The cylinders were 17¾ in. diameter by 22 in. stroke. Wheels, 48 in. diameter. This engine was easier on the track than those just described as the only overhang was at the smoke-box end. The weight on the leading wheels was 22,900 lbs., on the middle wheels 17,400 lbs., and on the trailing wheels 21,100 lbs.; total weight, 61,400 lbs. The link motion was of the ordinary type, but there were no rockers, the link block being connected directly to the valve rod, this rod clearing the front axle by the same arrangement in use on many locomotives to-day, and is clearly shown on the drawing. The valve chests were between the cylinders. The slide valves had two bridges making three exhaust ports, and these in conjunction with double exhaust ports in the cylinder had the effect of delaying the exhaust, but when it did begin, the release was quick. This valve is fully illustrated on page 58, of the Rogers Locomotive Works History, 1886. It was called the "Hackworth" valve, and when viewed on its face it looked somewhat like the old Dutch cabbage cutters found in many kitchens in the days of our youth. For this reason, all engines having this valve were known as "cabbage cutters," even after they had been refitted with plain D valves.

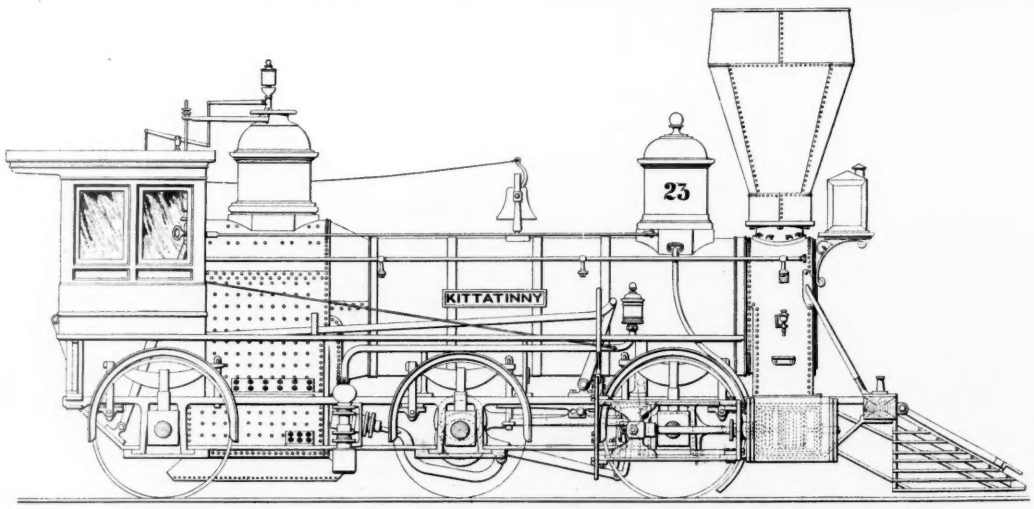


Fig. 21.—Delaware, Lackawanna & Western Railroad Wood Burning Freight Engine, 1855.

Hitherto, nothing has been said about the painting of these old engines. It was gaudy, and would be ridiculous to modern eyes, resembling that of the circus car or chariot. The specification of "Kittatinny" will suffice for the others. It calls for the following prismatic decorations: Wheels and cow-catcher, dark brown with vermillion stripes; frames, belly band, braces, wheel covers, and reversing shaft lever, green with black stripes; pumps, vermillion with black stripes; suction pipe (not shown on the drawing), green; smoke-box front, dark brown with scrolls; smoke-box door, green with vermillion stripes around it. Tenders were also enlivened with a surprising assemblage of vermillion, blue, green and purple, showing that engine builders knew little about the artistic combination of colors.

On Jan. 21, 1856, the Southern Division was so far completed that a locomotive and train passed over the Delaware river bridge, and on May 27 of the same year the road was formally opened for traffic. It was built for a double track, but only one track was laid at first. The rails weighed 75 lbs. to the yard.

The Southern Division comprises some of the heaviest grades, and passes through some of the most picturesque scenery on the D., L. & W. R. R., although, in this latter regard it would be almost invidious to make comparisons, for no railroad in America can show such an unbroken line of scenic beauty as the Lackawanna, and a brief description of this division, which includes four tunnels and was built under such costly and peculiar difficulties, may be given here.

Leaving Scranton, 740 ft. above tidewater, the line ascends a grade of 75 ft. to the mile through Nay Aug tunnel, and thence, still rising, about 53 ft. to the mile

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to Lehigh Summit, 1,887 ft. above the sea. From this point through Tobyhanna to Pocono Summit the road is nearly level and here commences a down grade of 78 ft. per mile to Sprague ville through heavily wooded hills clad with fern, rhododendron and mountain laurel—a sight of great beauty in the summer. Parts of this region are primeval forest and stocked with big game, even at the present day. With an altitude of 2,000 ft., the air is remarkably pure and New Yorkers are beginning to realize they have a mountain resort within three or four hours ride of the metropolis. Hotels for the accommodation of health seekers are springing up in the midst of sylvan glades. Whether these huge wooden structures harmonize with the beauty of their natural surroundings may be open to question, but they are certainly an indication of the growing popularity of this healthful country. Chief Engineer McNeil described it as a wilderness, and so it was, doubtless, to his tired body and jaded brain when grappling with the difficulties and discouragements but barely outlined in these notes.

From Sprague ville, through the world-famed Delaware Water Gap, we proceed by the Warren Railroad (a lease of which was taken in accordance with the agreement already explained) to Oxford Furnace, where the Scrantons had one of their iron works, and where cannon balls were made for Washington's army, and from thence to New Hampton Junction, originally the end of the Southern Division, the Lackawanna trains being there switched on to the tracks of the Central Railroad of New Jersey, whence they proceeded to New York over the third rail laid down for that purpose.

During the year 1856 eight other engines of the "Kittatinny" type were purchased from the same builders. The last one to be delivered was named "Roaring Brook," and came on in November. It had a four-wheel truck and made a very good 10-wheel freight engine.

In 1857 the valve chests of "Kittatinny" were removed and new ones placed on top of the cylinders in the usual way. A four-wheel truck was added and Watts Cooke informed the writer that the back gear eccentrics working the pumps gave much trouble, so the pumps were then changed to work from the crosshead.

During the three years prior to this period Watts Cooke had been trying to produce an improved hard coal burning locomotive, and on June 25, 1855, the company ordered from Danforth, Cooke & Co. two engines to be named "Delaware" and "Black Hawk." They were of the "Anthracite" class, but with a longer wheel base (no trucks), a larger fire-box and wider water spaces. Cylinders, 18 in. diameter by 24 in. stroke; wheels, 48 in. diameter. Both engines had the dome and cab in the same place as on the engine "Lehigh"; they had variable exhausts, and the Delaware had a balloon stack, while the "Black Hawk" was fitted with a straight open chimney. The latter engine differed from its companion in the way that the boiler was provided with a combustion chamber 4 ft. long, and the fire-box had a water space about 6 in. wide extending from the crown sheet to near the grates and running the length of the fire-box to within a few inches of the mouth of the combustion chamber, which was fitted with four holes on each side that could be opened and closed by a sliding damper worked from the cab. This water space design was substantially anticipated by J. E. McConnell, of the London & Northwestern Railway, in 1853.

In the summer of 1856, a coal train drawn by the Camel engine "Virginia" left Greenville to go to the siding at Nay Aug ("Roaring Brook") tunnel, to meet the express freight which left Scranton at 4 a.m. This latter train was hauled by the "Capouse," driven by Mr. O. W. Adams. For some reason, the driver of the "Virginia" failed to stop at the siding and continued towards Scranton. When he came nearly opposite the blast furnace at Scranton he met the express freight going south and there was a collision, the tender of "Virginia" being forced up against the boiler head, and the fireman, before he knew anything was the matter, was jammed between them, meeting the horrible death mentioned before in the course of this article.

In September, 1856, President George D. Phelps resigned, and Mr. Drake Mills became his successor, Col. G. W. Scranton and William E. Dodge continuing as the principal managers. In this year also the contract for laying telegraph lines from Great Bend to New Hampton Junction was closed. The work was pushed with all possible expedition, and the anxiety of superintendents without knowledge of the location of their trains was thus soon to be relieved.

Notwithstanding the success of the hard coal burning engines previously described, and in the face of all this progress, the idea still prevailed that coal burners could not be used for passenger trains, and, as a fast service was required for the Southern Division, a "first-class" wood-burning engine was ordered March 25, 1857, of Danforth, Cooke & Co. by President Mills personally, and it was delivered in February of the same year. This engine was named "Southport" and cost $11,500. It is illustrated in Fig. 22, and was built for the Ohio & Mississippi Railroad, which originally had a 6-ft. gage. As the construction of that road had been delayed the engine was ready before it could be received and it was therefore promptly delivered to the D., L. & W. R. R. It was a good engine, and a duplicate was ordered and delivered in the following May, and named "Col. Scranton."

These engines hauled the Southern Division mail trains and were considered marvels of beauty in their day, the cylinders, steam chests and dome being covered with polished brass. The cylinders were 17 in. diameter by 22 in. stroke. Driving wheels 66 in. diameter. The truck had outside and inside journals. The fire-box was 4 ft. 9 in. long, 3 ft. 11 in. wide, and 5 ft. high above the grate, which had 18.33 sq. ft. area. The details of this engine are fully illustrated in Clark & Colburn's "Recent Practice in the Locomotive Engine," London, 1860. The

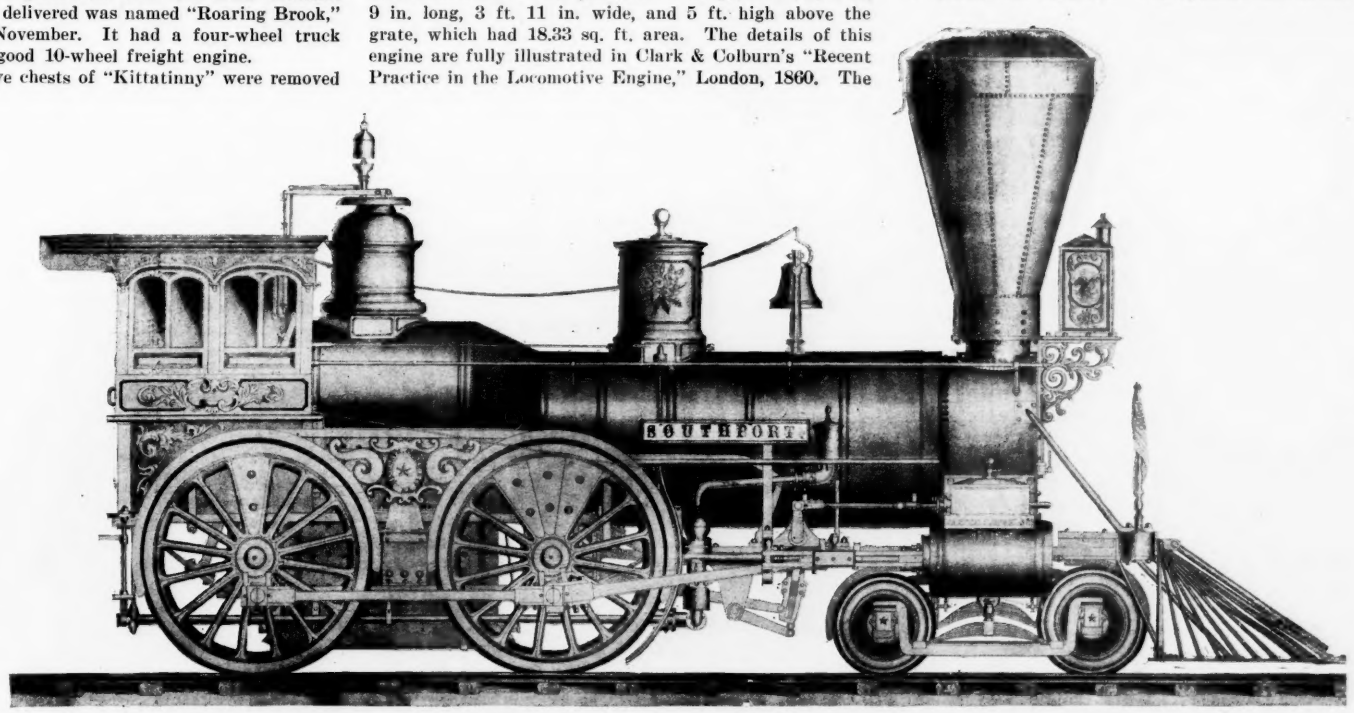


Fig. 22.—Delaware, Lackawanna & Western Railroad Express Engine—Southern Division.

fire-box, as well as the boiler, was covered with Russia iron and bound with brass bands. It was not until the year 1856 that fire-boxes were provided with jackets. Mr. O. W. Adams ran the "Southport" for many years, and for a part of the time Mr. Henry F. Colvin acted as fireman.

By the courtesy of Mr. David Brown, master mechanic at Scranton, the writer became acquainted with Mr. O. W. Adams by riding with him on his engine, drawing the train then known as the "Manhattan Special." It was a heavy passenger train and on the occasion referred to required an assistant engine from Scranton to Lehigh Summit. The ride over Mount Pocono on that bright summer's day will ever be remembered, the mountain laurel being in full bloom and the beautiful scenery at its best, Mr. Adams occupying a very different position to the one he filled 50 years ago, when he ran the way freight with the old "Capouse" (Fig. 14) that gave so much trouble breaking her inside cranks—the frames being out of square and one main rod ⅜ in. shorter than the other. Of course, no conversation took place during the journey, but on another occasion Mr. Adams gave valuable information now embodied in this article.

When the "Southport" commenced service it was numbered 57. In 1865 its name was changed to "W. E. Dodge" and so continued until 1876, when the railroad gage was altered to 4 ft. 8½ in. and the engine was returned to the builders to be narrowed. It was then also converted into a coal burner, and its name changed to "Sam. Sloan," and in 1890 it was sold to the Morris and Essex Division and renumbered 146.

At the commencement of the year 1857 Superintendent Dotterer retired from the position he had so ably filled, and in the same year an engine named "Fairfield" was received from the Taunton Locomotive Works, being shipped by water to Elizabethport. It was a regular eight-wheel passenger engine, the only unusual feature being the boiler, which was on the "Dimpfel" system. It was a water tube boiler, the tubes commencing at the fire-box crown sheet and curving downward and forward to a water space at the smoke-box end. Colburn in describing this class of boiler stated that the circulation through the tubes was vigorous, not to say violent—sufficient, indeed, as was ascertained, to bring a ½ lb. bolt, purposely left in one of them, up to the crown sheet. But the boiler was heavy in proportion to the heating surface, and leaky tubes were very difficult to locate and remove. This and other objections condemned the engine and it did not last long.

(To be Concluded.)

The National Bureau of Standards.

The contract for the mechanical laboratory for the National Bureau of Standards has been let to Pavarini & Greer, of Washington, D. C., and the contract for the physical laboratory which is to be the larger or main building, will be awarded soon, work on both buildings to be begun at once and completed in about 14 months. The site for the Bureau, as mentioned in these columns last summer, is some distance out of and above the City of Washington, near the Chevy Chase road, and contains over seven acres.

The mechanical laboratory will be 135 ft. long, 50 ft. wide and three stories high, and will contain the power and lighting plant, storage batteries, special alternating-current machines for experimental and testing purposes, refrigerating plant, heating and ventilating plant, machine and carpenter shops and laboratories for heavy electrical testing, photometry, gas and water testing. The boiler room will have two 125-h.p. boilers with space to double that capacity. The dynamo and engine room will have two 80-h.p. high-speed engines each direct-connected to two 25 kilowatt direct-current generators, and additional space will be provided for double this equipment and for some special alternators.

For the heating and ventilating system the air will be supplied through ducts by electrically-driven fans, the temperature in each room to be independently controlled by thermostatic dampers and the air to be renewed every 15 minutes. In winter the air to be heated will pass over coils fed with exhaust steam, and in summer it will be cooled by coils through which brine is circulated. The refrigerating plant will cool the air and make ice.

An instrument shop will be equipped with motor-driven lathes, milling machines, shapers, drills, etc. A liquid air plant will also be installed for experimental use.

The main building will be 150 ft. long, 50 ft. wide, four stories high, and will contain about 50 rooms. It will be equipped with apparatus for verification work and for special investigations and provided with gas, electric light, compressed air and a number of independent electric circuits. The basement of the main building, which is about level with the ground, will be used entirely for the more precise and accurate work, and there will be four special temperature rooms. The second floor will be used for administrative and clerical work, library and museum; the third floor will contain a well-equipped chemical laboratory, part of which will be a laboratory for photometric research, and this floor will also have a lecture room to seat about 150 people. Both buildings will be of brick with stone trimmings, and the two will cost $325,000, an additional $40,000 having been appropriated for equipment, making the total amount available $365,000.

The work of the Bureau of Standards has increased so rapidly since it was first organized in March, 1901, that it has been found necessary to rent an additional building for temporary quarters in addition to the space for temporary offices in the Butler building. The clerical and scientific force of the Bureau has also been recently increased.

The Royal Alexandra Bridge at Ottawa.

BY H. D. BUSH, *M. Am. Soc. C. E., M. Can. Soc. C. E.*

At the time of the visit of the Duke and Duchess of York in September, 1901, the new bridge across the Ottawa River between Ottawa, Ont., and Hull, P. Q., was formally opened, and named the Royal Alexandra Bridge. The total length of steel work in the Alexandra Bridge and approaches is about half a mile. The river spans cover a length of 1,600 ft., and are 66 ft. wide. The bridge is just below the Parliament buildings at Ottawa.

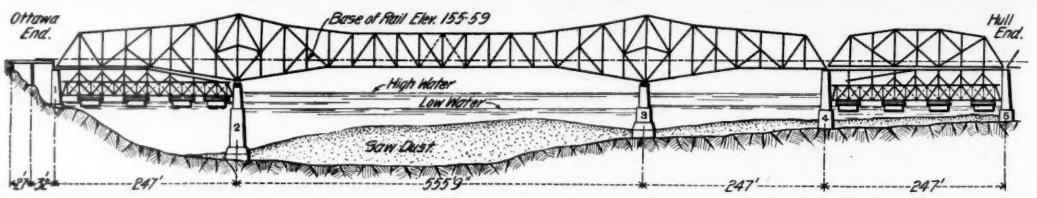


Fig. 1.—Elevation of Ottawa Bridge Showing Scows and Trusses Used in Erection.

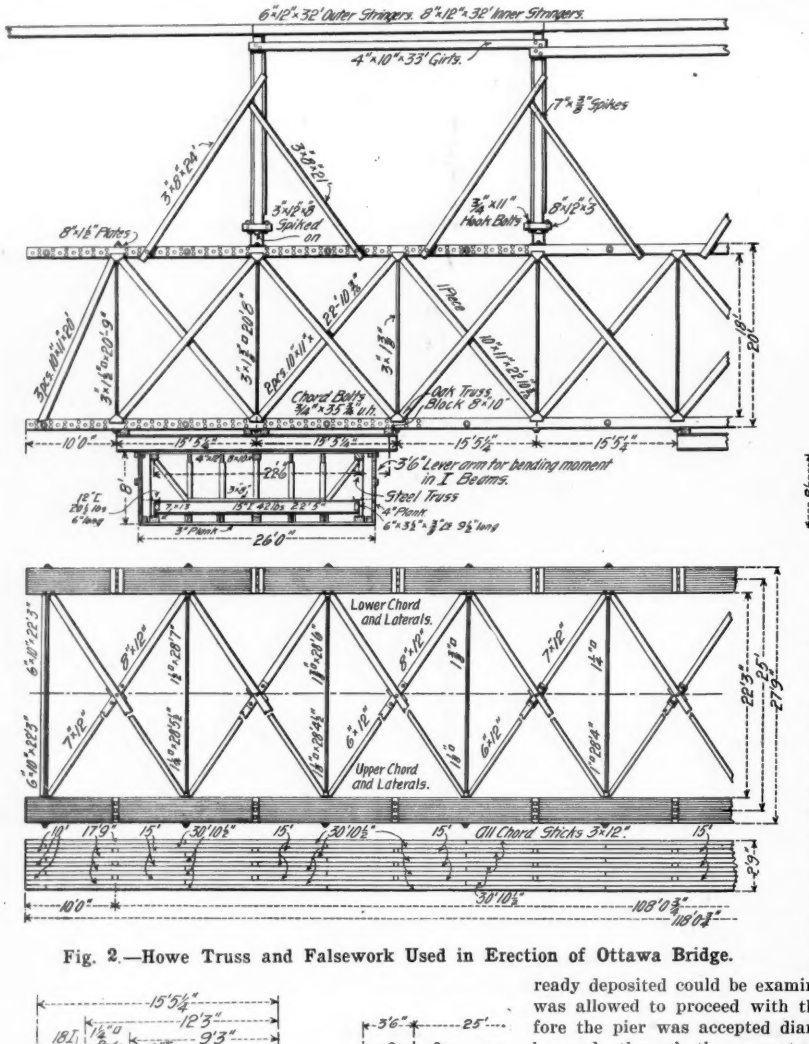
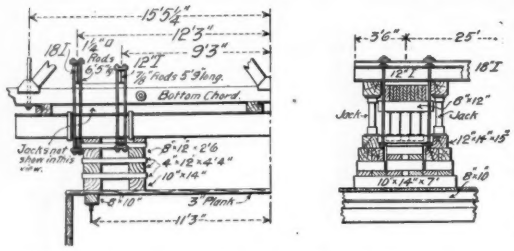


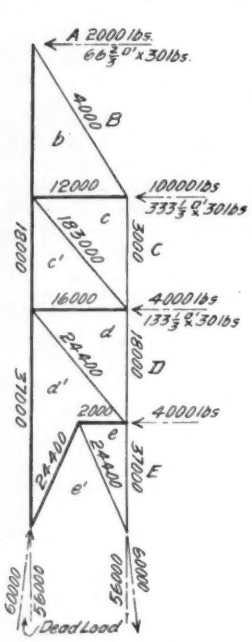
Fig. 2.—Howe Truss and Falsework Used in Erection of Ottawa Bridge.



Method of Jacking Falsework During Erection.

It carries one steam and two electric railroad tracks, and two roadways and foot walks.

The profile of the river bottom at the bridge is shown in Fig. 1. The water deepens rapidly to 70 ft. next the Ottawa shore. The bed rock (except at this point) is covered with a deposit of sawdust and general mill refuse mixed with water-soaked logs, the deposit being in one place 50 ft. deep. This deposit had to be dredged to uncover the bed rock for each pier foundation. These were made by sinking caissons, of 12 in. x 12 in. hemlock timber, having outside pockets at the bottom containing broken stone and sand to sink them. The bottom edges of the caissons were scored to approximately fit the bed rock, and after they were sunk divers packed all crevices so as to provide still water in the enclosed space. Concrete was then deposited up to within about 2 ft. of low water level. The remaining water was then pumped out, the concrete leveled off, and the masonry started.



Equilibrium Diagram of Traveler.

During the construction of pier No. 2 in the deepest water, the wreck of the Cornwall Bridge* occurred, and until the real cause of that wreck was known, concrete piers founded in this manner were discredited, though they have been much used in Canada. The Department of Railways and Canals ordered work on this pier stopped, and for a time insisted that arrangements be made to pump out the caisson so that the concrete already deposited could be examined. Finally construction was allowed to proceed with the understanding that before the pier was accepted diamond drill borings should be made through the concrete to the bed rock. These borings were successfully made, and cores brought up in pieces 3 in. to 6 in. long, which are now stored in the Government buildings at Ottawa. This work was important in fully establishing the fact that concrete when deposited in still water at even the considerable depth of this pier hardens well enough for practical purposes if not as well as when placed in the open air and tamped. During construction divers were occasionally sent down. They always reported that the concrete filled out solidly against the sides of the crib. The concrete mixture, after the Cornwall disaster, consisted of one part Portland cement, one of sand, and as much stone as this would properly take. Run-of-the-crusher stone was used. The concrete was deposited in steel kibbles opening at the bottom, made wedge shaped, small end down, so as to create as little disturbance as possible in sinking. A canvas cover was securely tied over each kibble. Several tests were made and good results obtained by lowering the kibble to a depth of 50 ft., then raising it and depositing the concrete in boxes under water. These experiments showed that little or no cement washed out of the concrete. Diamond drill borings were also made through these experimental blocks.

**See Railroad Gazette, Sept. 9 and 16, 1898.*

The superstructure was designed, with the approval of the Dominion Government, for the following loads:

On the steam railroad track, two 161,000 lbs. locomotives with 36,000 lbs. on each of four axles 4 ft. 6 in. c. to c., and 22,000 lbs. on each tender axle followed by a train load of 3,000 lbs. per live ft.

On each electric railroad track, 15,000 lbs. on each of two axles 7 ft. c. to c., this taken as the load covering 30 ft. of track—four such loads coupled being taken as a moving load, covering 120 lineal feet of track.

On the roadways, each 8 ft. wide, 40 lbs. per sq. ft. for stresses in trusses, or a 13-ton road roller for the floor system.

On the foot walks, each 5 ft. wide, 20 lbs. per sq. ft.

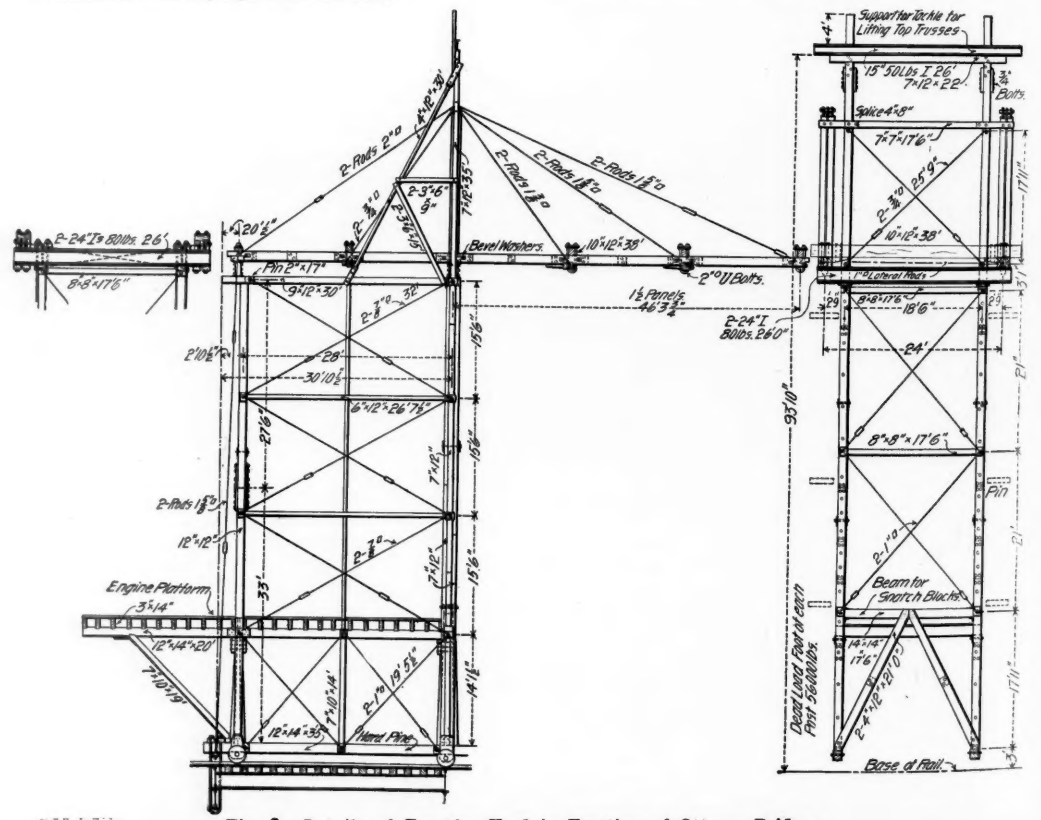


Fig. 3.—Details of Traveler Used in Erection of Ottawa Bridge.

for the trusses, and 70 lbs. per sq. ft. for the floor system.

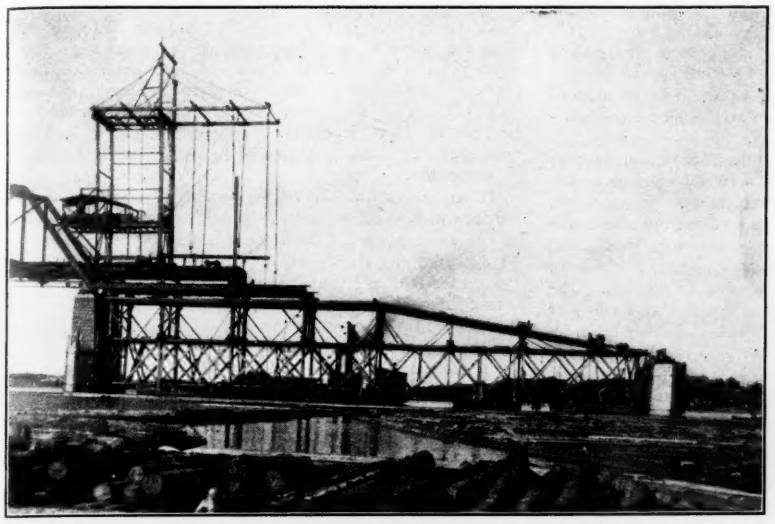
The bridge trusses were made 24 ft. center to center in order to secure sufficient width for the lateral system in the long span. The single line of railroad is in the center of this space, and the foot walks each side. Floor beam cantilevers project 21 ft. on each side of the bridge and carry the electric tracks close to the trusses and the roadways next the outside. A very substantial fence designed to resist a horizontal force of 2,000 lbs. at any point was therefore used. It is 5 ft. high with rails of 6 in. channels and pickets of ¾ in. round rods. Posts are spaced about 15 ft., or half a panel length, apart and braced to floor beams and stringers.

rods, which resisted the tension at this point during erection. The top lateral bracing was omitted in panels N 6 and U 9 to insure the lateral stresses being transferred down the main inclined members S 6-7 and S 9-8.

The number and thickness of shim plates inserted at these points determined the length of the projecting half span during erection.

The lateral bracing was all riveted. The top laterals were omitted in panels U 6 and U 9 to insure the lateral stresses being transferred down the inclined members S 6-7 and S 9-8. A wind pressure of 30 lbs. per sq. ft. was assumed acting on twice the area of the trusses and on the actual area of the flow system inside elevation,

The cantilever roadway floor beams and the stringers between them were placed in position on each span, after the span had been erected and become self-sustaining. The weight of steel work supported by the four scows during the erection of one span was about 910,000 lbs. The Howe truss and top falsework, etc., added to this 390,000 lbs., making 1,400,000 lbs., or 350,000 lbs. per scow. In addition to this each scow in turn had to support the weight of the traveler (except as it might be partly distributed by the Howe truss) amounting to about 140,000 lbs. The maximum load for each scow was 450,000 lbs., or 112,500 lbs. at each of the four points of bearing.



Beginning Erection of Span 4-3—Ottawa Bridge.

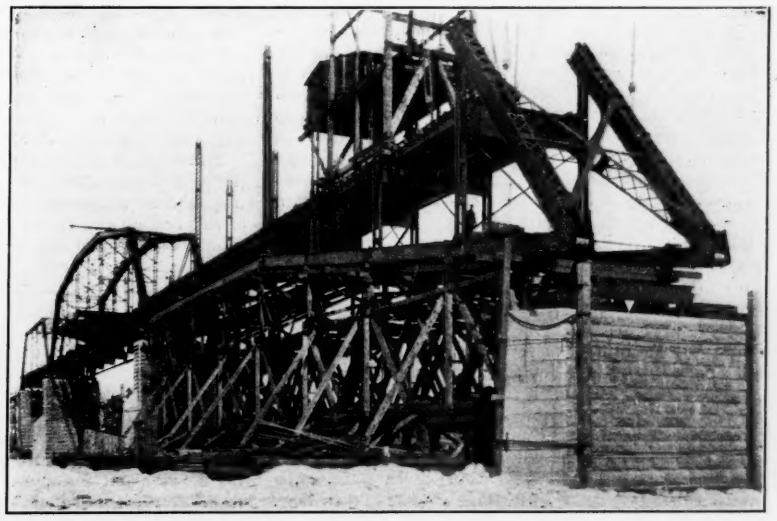


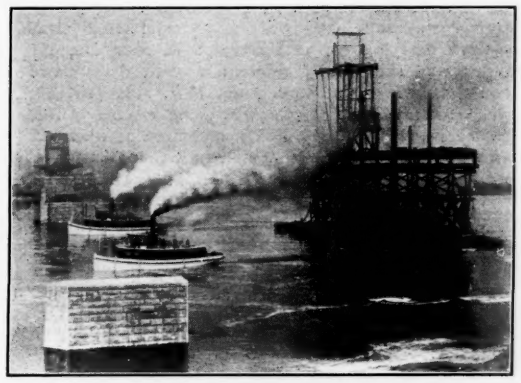
Fig. 4.—Span 3-4 Ready to Move Across Ottawa River, April 2, 1900.

The roadways do not cross the steam railroad track at grade. At the Hull approach the track runs out on a level grade from the bridge on a single track trestle with plate girders over the street crossings. The roadways from pier 6 descend on steel trestle work on either side on a 5 per cent. grade until a level is reached which permits of one roadway passing under the steam railroad track. Passing from Ottawa, the right hand roadway is on the same grade as the tracks, while the left hand descends through a rock cut, bridged by plate girder spans, crosses under the tracks and rises again on a 5 per cent. grade to the level of the bridge floor.

The length of spans and their general construction are shown in Fig. 1. The Dominion Government required a clearance of 45 ft. above high water under the central portion of the long span. Piers 2 and 3 were made lower than the others and the bottom chords of the cantilever span inclined from the outer point of the fourth panel. This made a saving in height of masonry and total height of structure.

The anchorage of the cantilever at pier 1 required nearly the whole weight of this pier. The steel girders and I-beams are built into the masonry 33 ft. below the top of the pier. The bottom bearing is on cast bolsters, through which pass adjustable hangers pin connected to the eye-bars. These ascend through two wells in the pier, and are connected to the end pins of the anchor arm span. To avoid the use of wide masonry at pier 4, a double shoe was used with two pins one over the other, the lower pin connecting with the anchor arm span, and the upper with the adjacent span. Half the weight of this span was, therefore, utilized as anchorage, so that only a small portion of the weight of the masonry was required. Loop rods instead of eye-bars and lighter girders were therefore used.

and also on a moving train 10 ft. high. The wind pressure from flow and train is transferred to the lower lateral system by knee braces from the floor beams to the lower chords. The main truss members are all pin-connected, the pins varying from 6 in. to 9½ in., while



Crossing the Ottawa River.

those in the pedestal in piers 2 and 3 are 14 in. in diameter.

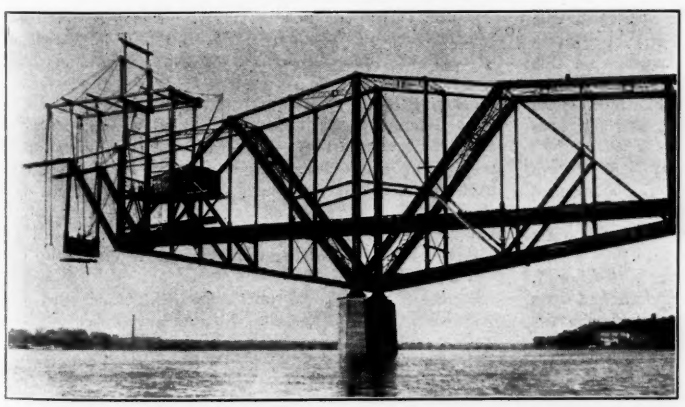
The posts on these piers are 90 ft. high, c. to c. pins, made in two sections, weighing 24,000 lbs. each. The suspended span is 45 ft. high between pin centers. The panel length in all span is 30 ft. 10½ in.

Each scow contained two longitudinal steel trusses, 22 ft. 6 in. apart c. to c., 6 ft. 3 in. high, and divided into panels of 6 ft. 3 in. Opposite panel points of the bottom chords were connected with 15 in., 42 lbs. rolled I-beams, under which were 4 in. x 12 in. longitudinal timbers, to which the 3 in. bottom planks were spiked. The scows were 100 ft. long, 26 ft. wide, and 8 ft. deep outside measurements. Timber posts above the floor beams supported timber deck beams and planking. The construction of the scows is shown by Fig. 2.

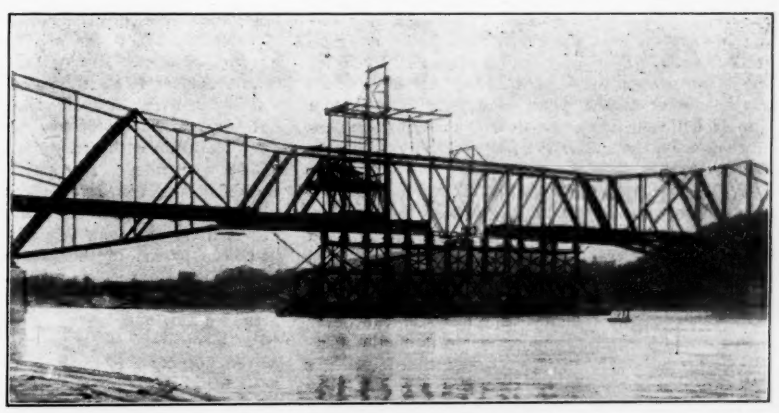
The maximum estimated load of 450,000 lbs. per scow corresponds to a draft of 4 ft. 1½ in., leaving nearly 4 ft. freeboard. It was proposed to take care of most of the variation in the water levels by pumping water into or out of the scows, starting work with water enough in them to give about 5 ft. draft, pumping in more if the river rose, and pumping out if the river fell, and in any case pumping out water to correspond to the weight of metal added as erection progressed. Six 6 in. steam siphons were used for this work, steam being furnished from two upright boilers of 20 h.p. each placed on one of the scows.

There is comparatively little change of level in the Ottawa River at this point in the months of October to March inclusive. Floating falsework was adopted for this work in the expectation of using it during these months. It was found necessary to block between the scows and Howe truss for the erection of the span on the Ottawa shore in the summer of 1900, owing to low water in the river.

On account of the difficulty in getting delivery of steel



Beginning Erection of Suspended Span.



Driving the Last Pin—Ottawa Bridge.

ERECTING.

Somewhat novel methods were employed in the erection work. The two anchor arm spans of the cantilever were each 247 ft. long, and the span between piers 4 and 5 was made of the same length. The contractors for the superstructure decided to use the same falsework for each cantilever span, building it, on account of the great depth of water at pier 2 and steep rock bottom at pier 1, so that it would float and sustain the erection loads by its buoyancy. The floating falsework consisted of four scows connected together by two Howe trusses, which they supported, the trusses serving to partly distribute the loads over the scows, and also to connect them together, so that the whole structure could be floated from span to span.

Temporary struts from L 6 to M 7 were required during erection to make the anchor arm spans self-supporting. These were made of two pieces 12 in. x 12 in. timber. The suspended span was 8 panels, or 247 ft. long, and hung by the long suspenders from the end of the cantilevers. At L 13 bearing blocks were fitted to one side of the pin with shim plates between this and diaphragms riveted near the end of the chords L 12 to take compression during erection. At U 14 yokes from the pin led back to diaphragms riveted in the chord U 13. Slotted shim plates were dropped over these yoke

in 1899, the erection of the first span near the Hull shore, for which the floating falsework was used, did not begin until Jan. 12, 1900, instead of about Oct. 1, 1899, as had been intended. The floating falsework had, therefore, to be moved from span to span through the ice. According to original plans the first change would have been made before the river was frozen over, and the second change early in the winter, when the surface ice would have been thin and there would have been no frazil in the water.

The trusses over the scows were of the Howe truss type 20 ft. high. The panels of the bridge were 30 ft. 10½ in. The Howe truss panels were one-half this, or 15 ft. 5¼ in. The angle blocks were of oak with 10 in. faces. The chords were made 33 in. wide of 3 in. x 12 in. plank,

dressed to exact thickness. There were eight continuous leaves (four in each panel), and also in each panel three packing and splicing pieces, 3 in. x 12 in., 15 ft. long, between the ends of which were spaces through which passed the rods, 3 x 1⅜ in. sq. at each panel point. The planks were well bolted together with 28—¾ in. bolts per panel. The braces were each 2 pcs. 10 in. x 11 in., and counters 1 pc. 10 in. x 11 in.

As a safeguard in case of accidental sinking of one of the scows and to increase the resistance to wind on the high traveler, tending to tip the scows, the extreme ends of the Howe trusses were kept blocked up on timber bents placed on the concrete foundations of the piers.

On top of the Howe trusses seven bents of falsework were placed all 20 ft. high for the span between piers 4 and 5. Three of the bents were afterwards made respectively 15 ft., 10 ft. and 5 ft. high to fit under the bottom chord of the anchor arm spans. Four 20 in. I-beams 32 ft. long were placed under each Howe truss bottom chord across the scows to prevent bending stresses in these chords from the reaction of the steel trusses in the scows. When in use the scows were held in place by anchors, and the ends of the Howe truss chords were also held by the upright 14 in. x 14 in. timbers of a harness built around the piers.

The 140 ft. span between piers 5 and 6 was erected on ordinary falsework, and finished Jan. 3, 1900. As soon as this span was completed, the erection of the cantilever traveler was begun upon it. This traveler consisted of a rectangular "inside" tower supporting top trusses which overhung at each side, in the plane of the bridge trusses, and also overhung one and one-half panel lengths, or 46 ft. 3¾ in. in front of tower, for the cantilever work. When the tower was erected, the two top trusses were put together on the ground, one on each side of the bridge, and hoisted up one at a time, the stress on the lifting tackles being about seven tons. The traveler tower was made 18 ft. 8 in. wide and 28 ft. long, c. to c. of posts. This width just gave clearance on each side inside the bridge trusses. The length of the tower was made less than the bridge panel length so that with the center of the forward posts at a panel point, the top lateral and upper portions of sway bracing could be bolted in place in the panel just behind the traveler. The rear posts were 12 in. x 12 in. The forward posts were each made up of three leaves of 7 in. x 12 in. timber bolted together to break joints. The two outer leaves were 63 ft. high. The center one extended up 30 ft. higher as a gin pole, and supported a 7 in. x 12 in. cross timber 22 ft. long, and over that a 15 in. 50 lb. I-beam 26 ft. long, to which the tackles for lifting the top trusses were attached. The tower was braced on four sides by horizontal timber struts and diagonal adjustable rods, except in the bottom panels of the transverse bracing. About 16 ft. above the track there was a working platform which extended 20 ft. back of the rear posts. Just above this platform, between the forward posts, the timber strut of the wind bracing was replaced by a 14 in. x 14 in. cross timber intended as a beam to hold the snatch blocks, through which lines from the erecting tackles led to the hoisting engines. From the center of this beam plank braces to the bottom of the posts completed the transverse wind bracing. A similar but lighter construction was used between the rear posts. This arrangement left a clear space for a central track on which material was brought forward.

Two 24 in. I-beams were placed across the traveler over the forward and rear posts. These beams projected on each side far enough to give support to the top trusses, which were placed 24 ft. apart c. to c., to correspond with the bridge trusses.

The anchor rods from the back of the top trusses were fastened to the sills of the traveler. The traveler ran on eight 24 in. double flanged wheels, two under each corner, the weight on each forward wheel being approximately 30,000 lbs. Double lines of rails on each side of the bridge were supported by ties laid on stringers of 20 I-beams belonging to the outer roadways. These were temporarily bolted between the floor beam webs, and removed when convenient after the traveler had passed over them.

When the traveler was in use, short rods fastened the rear ends of the sills down to the floor beam underneath, and iron wedges were placed under the forward truck castings to prevent excessive loading on forward wheels and axles. Fig. 3 shows rear, side and front elevation of the traveler.

The traveler, though designed especially for cantilever work, was used for erecting the heavy spans on the floating falsework and handled them very well, first advancing from pier to pier and assembling the floor systems, lower chords, and vertical posts, then returning to its starting point and going forward once more assembling the top chords and remaining web members. The top lateral and sway bracing were handled by a swinging boom projecting behind. The engine platform carried a 20 h.p. upright boiler and two double 7 in. x 12 in. engines operating eight spools.

Just before the completion of the span between piers 5 and 6, a small ice-cutting plant had been put in use and sufficient ice cut and removed to make room for the first movement of the scows about 80 ft. up stream. The weather at that time was very mild and the ice only 10 or 12 in. in thickness and the water free from frazil. The weather suddenly became very cold, averaging close to zero for several days, and firm ice not only formed where the first ice had been cut, but the shallow water between pier 5 and the Hull shore filled full of frazil. These fine floating crystals formed in the open water at the Chaudière Falls about three-quarters of a mile above the bridge, and in the rapids just above the falls were known to pack, having often in former years, according to various reports, lifted the surface ice and forced it up in ridges. It proved nearly as difficult to move the scows over the packed masses of frazil as it would have been to move them over soft mud. The surface ice was kept cut around them day and night. Heavy tackles were rigged to pull the falsework ahead, the heavy lines of four tackles being led from the scows to various engines, and men and teams were used on one or two more. There were a great many breakages of 2 in. ropes, 1¼ in. chains, shackles of 16 in. triple blocks, etc., etc., and after nearly four weeks of hard and expensive work the scows were brought to their new position between piers 3 and 4.

It being now nearly March 1 the season was so far advanced that it was thought to be running too great a risk to try and erect this span, as the records showed that the ice in the Ottawa River at this point occasionally went out as early as March 15.

There was a double shoe on pier 4 arranged so that the weight of one-half the span between piers 4 and 5 was used as anchorage for the cantilever. The erection of this anchor arm span after the flow system and lower chords were placed would have necessitated connecting with the double shoe, and after which a sudden rise in the river might possibly have wrecked two spans. The falsework was accordingly moved a few feet towards pier 3, and erection started clear of pier 4, it having been decided to erect a considerable portion, all but the top chords and upper portions of the inclined web members, of an anchor arm span, and float it across to the Ottawa shore, erecting it there between piers 1 and 2 during the spring freshet. Each of the top falsework bents had been cut down 5 ft., and the Howe trusses jacked up from the scows about 5 ft., crib blocking being placed under them over the bearing points on the scows. This left the falsework at its original height, but made it possible to vary its height while working during the spring rise, when the variations in water levels would be much greater than in the winter months. By April 2 as much of the span as desired had been assembled and work was stopped except on the trestle approaches. The condition of the span and floating falsework at this date are shown in the photograph (Fig. 4). This view also shows on pier 3 the upright timbers of the pier harness. On April 21 the river was sufficiently clear of ice, and the floating falsework carrying the partly completed span and the traveler was successfully towed across to the Ottawa shore. The water was then about 6 ft. above average winter level; while the span was being erected it rose 5 ft. more and had dropped back that amount when the span was completed. Each scow in turn was then jacked down about 10 in. at a time and that much blocking removed. Water was pumped into each scow to help the jacks, and then pumped out after the blocking had been readjusted. In this way the whole 5 ft. of blocking was removed and the span landed in place on the piers May 29, 1900. The scows were then towed back across the river for the erection of the anchor arm span between piers 3 and 4, which, however, could not be begun until the completion of the half cantilever span projecting out from Pier 2.

This cantilever arm was finished to the central panel of the suspended span on July 10, and the work of taking down the traveler began. The top trusses were lowered complete to the deck of the derrick scow, anchored in the river underneath, the tower was lowered piece by piece and then the tackles, engines, boilers, etc. Four and one-half days in all were occupied in doing this work.

The traveler was re-erected over pier 4 at the end of the 247 ft. span, which had been finished Feb. 1 preceding. The erection of the anchor arm span was started July 24, with the river about 4 ft. above average winter level. During the three weeks work on this span the river fell 3 ft., about one-half of this after the connection with the double shoe on pier 4 had been made, but the falsework was maintained at a practically constant elevation with little difficulty.

The adjustments for length in the top and bottom chords of the cantilever at the ends of the suspended span have already been described. No mechanism was provided for changing this adjustment after these points had been passed in the progress of erection.

The final connection was not made until October 7. The temperature was then a little lower than had been arranged for, and it was found necessary to change the adjustments for length, which was easily done by means of the floating falsework. The scows were partly filled with water and placed under the suspended span on the afternoon of Saturday, October 6. Blocking was placed under the panel points of the truss and the water partly pumped out of the scows during the night; early Sunday morning the pumping was finished and the weight of the span lifted. The yokes at the adjusting points were loosened and the two half spans jacked together, the last pins being driven at 11 a.m.

The general contractor for the bridge and approaches was H. J. Beemer, his engineer during construction being Guy C. Dunn. The river substructure contract, Piers 1 to 5 inclusive, was let to Chas. H. Deans, of New York City. The superstructure was designed and built by the Dominion Bridge Co., Ltd., of Montreal and Lachine, P. Q. The general erection scheme (afterwards worked out by the writer) was originated by Phelps Johnson, C. E. Computations were in charge of G. H. Duggan, C. E., chief engineer, and F. P. Shearwood, assistant engineer.

The Pittsburgh Plant of the American Bridge Co., Near Economy, Pa.

The American Bridge Company has acquired an extensive area of land on the Ohio River near Economy Station on the Pittsburgh, Fort Wayne & Chicago, about 15 miles below Allegheny. The manufacturing site is comprised of about 150 acres lying between the railroad and the river, and extending from Economy Station up to the Sewickley creek, and on this land construction of the new bridge manufacturing plant is begun.

The company has also pre-empted an area of about 125 acres on the upper plateau above the railroad and adjoining the village of the Harmony Society at Economy. This latter property is intended for a residence district. It is the intention to concentrate at this point the older plants of the company in the Pittsburgh District. The plant will be the most extensive of its kind in existence and will have a producing capacity of 15,000 to 20,000 tons per month of miscellaneous structural material. The accompanying plan will indicate the general arrangements of the shops.

These are paralleled by a system of standard gage tracks which communicate with all the shops and connect to the Pennsylvania Lines. A belt line of 3 ft. gage to be operated electrically also surrounds the works. Near the center will be situated the receiving stock-yard of the establishment, where all the mill material is received and distributed for its passage through the shops. This stock-yard is covered by a system of traveling cranes extending from the railroad towards the river and at right angles to the direction in which the material moves. At the delivering ends of the bridge shops similar cranes of greater capacity and located for handling and loading the finished product and at points elsewhere as described on the plan will be located similar parallel systems of traveling cranes for the convenience of contiguous shops. These cranes have all a uniform span of 60 ft. and are interchangeable on their respective runways. Toward the railroad end they connect with a gantry which runs parallel with the railroad by means of which cranes can be transferred from one point to another as convenience requires, or a special heavy crane can be placed on any runway to facilitate the handling of exceedingly heavy pieces.

Main Bridge Shop.—The main bridge shop will be 270 ft. wide by 780 ft. in length. The whole area of this shop will be covered by a system of electric hoists operating transversely. At the lower or discharging end of the shop facilities are provided for handling and machining structural members of over 100 tons weight or over 120 ft. length. Many of the tools in this shop will be of special design, such as multiple punches for simultaneously punching standard beam connections, and punches with automatic tables or adjustable spacing racks. Multiple radial drills carried on longitudinal moving gantries will serve for the usual drilling and reaming. Riveters of special design will be carried on gantries or traveling wall-brackets. All revolving machinery will be electrically driven, no vertical belts being required, thus clearing the whole overhead area for the free use of the electric hoists.

This building is flanked with lateral wings which serve as tool rooms, shop offices, etc. The general construction will be steel, and all wall surfaces not of glass will be filled with cement concrete. The only combustible material used will be the wooden sheathing for the roof. Longitudinal narrow gage tracks at suitable intervals extend from the stock-yard through the shop to the loading cranes, on which material will be carried by power operated tracks.

Auxiliary Bridge Shop.—Paralleling the main bridge shop and between it and the river, space is reserved for an auxiliary bridge shop. This shop will be fitted up for handling special structural work of a lighter or more complicated type.

Templet Shop.—Between the structural shops will be a templet shop, about 60 ft. wide and 500 ft. long. This shop will be provided with longitudinal galleries along both sides. The main floor of this shop is lifted sufficiently above the general level to permit the use of its basement for closets, lavatories, etc. Lumber will all be stored in an outlying building, and will be delivered by means of the narrow gage track, heretofore described.

In the up-river direction across the stock-yard the power house is established. The motive power for the present will be derived from steam boilers, although gas engines have been considered and may possibly hereafter be adopted. Boilers at present to be installed are of the water tube type, provided with automatic stokers and fuel and ash conveyors. At this point will be located all the engines; direct-connected electric generators; air compressors; hydraulic pressure pumps, and the pumps for the general water supply. Water will be drawn from wells located near the river's edge. The water is discharged into a storage tank situated near the power house. In an emergency, such as an outbreak of fire, connection between the pumps and the tank can be closed. The pumps are so designed as to deliver high pressure into the mains for fire service. The steam engines of the power house will all be of the compound condensing type designed to work under an initial pressure of 150 lbs.

Above the power house is situated the hydraulic forge for eye-bars. This shop will shortly be in operation. It will contain two separate systems of hydraulic forging machinery, one set for finishing bars up to 8 in. in width. The other set will handle bars up to 16 in. in

width, with heads 36 in. in diameter. This latter system will be the most powerful of its kind in existence. The main upsetting machine will weigh 250 tons, is almost entirely of steel, and is capable of exerting an upsetting pressure on the eye-bar of 1,500 tons and a simultaneous holding down pressure on the bar of 3,000 tons. Hydraulic shears will be capable of cutting cold bars of 16 in. x 3 in. with a shearing pressure of 1,000 tons. The vertical punch will be capable of punching 14-in. holes through 3 in. material, hot, and exerting a pressure of 1,000 tons. Suitable rolling and straightening machines will be installed. All the furnaces will be heated either by oil or natural gas. The annealing furnaces are designed for continuous operation. All this hydraulic machinery will be supplied with water from the power house. A pressure of 600 lbs. per sq. in. will be maintained in the service pipes, and each machine will be supplied with suitable intensifiers to elevate this initial pressure if desired. In some cases this will be over 6,000 lbs. per sq. in. The eye-bar shop will be traversed by electric traveling cranes.

The bending and forge shop is situated next to the stock-yard. Immediately above the latter shop is a building of similar design and dimensions which contains all the machinery for making the rivets, bolts and nuts. It will have a capacity of about 1,000 tons of rivets and bolts per month. Further up the river, as shown on the plan, are located the machine shop, pattern shop, iron foundry and testing laboratory.

Iron Foundry and Steel Foundry.—At the ends of these buildings are electric traveling cranes. These cranes are of the same span and height as those which serve the bridge shops. At the railroad end they terminate and connect with the same transferring gantry.

The electric current from the central power station will be transformed by a multiple voltage system in each shop into currents of different potentials. The motors on all principal tools will be directly connected. The system of electric trolley service will be extended over the whole shop, so that all tools where the magnitude of the work requires will be served with power handling devices.

The central avenue of the shop will be covered by a double system of runways one above the other. The lower runways will carry a clear span crane and those above will carry two shorter cranes. Several special machines for the convenient handling of turntables and bridge work will be installed.

The pattern shop will be situated between the machine shop and foundry. The building will have a basement similar to that previously described for the templet shop.

The iron foundry will be a building of the same size and general style as the machine shop, and will contain the same arrangement of traveling cranes. The foundry will also be equipped with a system of traveling radial cranes. The cupolas will be served with hoisting and charging machines. Natural gas will be used throughout the foundry for core baking and mould drying.

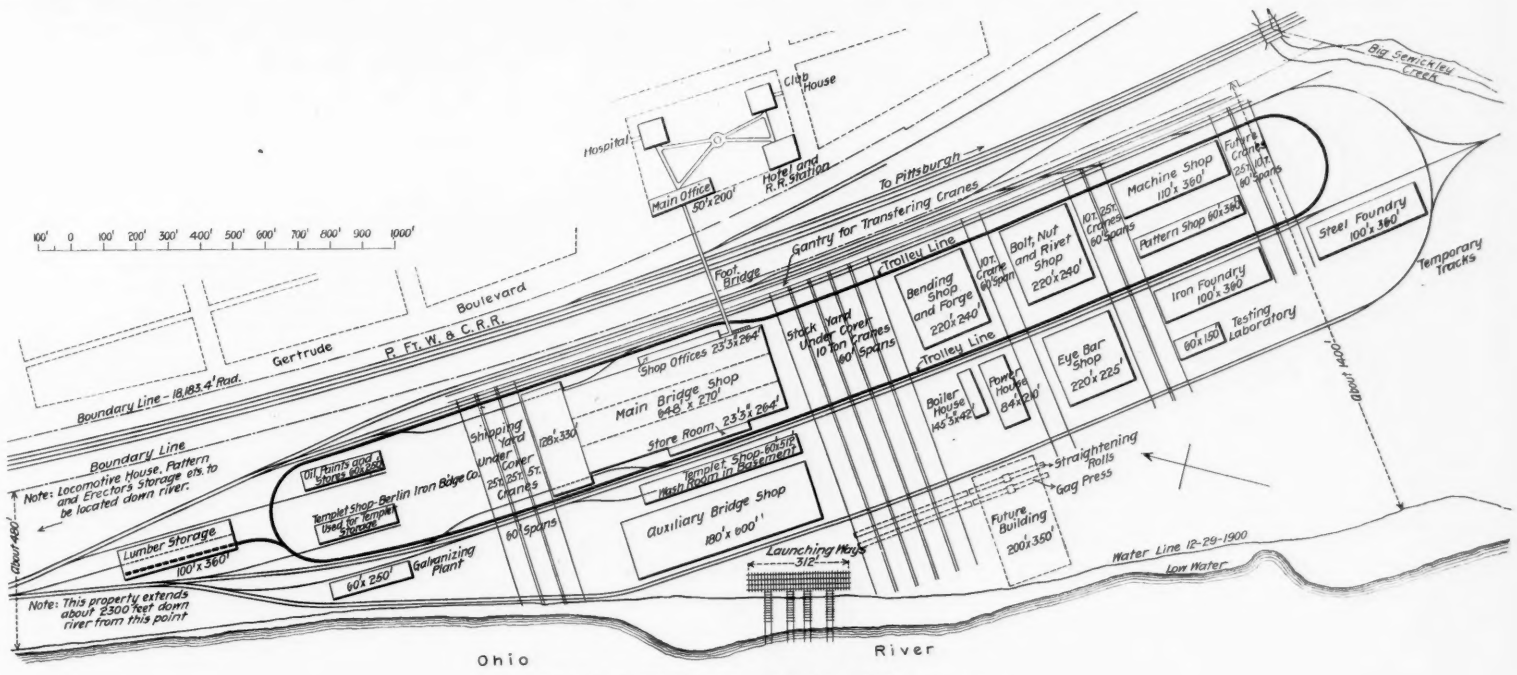
The steel foundry is not yet completely developed, but it will be as large as the iron foundry. The testing laboratory will contain, in addition to the minor machines for tensile tests of steel specimens, an equipment for testing cement concrete and other building materials, and also a powerful machine for testing the largest eye-bars. It is contemplated to install in this department appliances for the use of the inspection department.

As accessories to the plant there will be buildings for general storage supplies such as lumber and patterns, erector's tools and material.

On the opposite side of the railroad and about 20 ft. above the railroad level is an extensive plateau. The main office of the establishment will be on this upper level next to the railroad company's property and opposite to the center of the works, with which it will be connected by an over-grade bridge. The office will contain the drawing room, which will be of sufficient size to accommodate about 500 draughtsmen.

Ample land is reserved for the manufacture of steel barges and similar river craft in the future.

The construction of these works is now under way, and it is expected that the plant will begin operations during the coming year.



The Pittsburgh Plant of the American Bridge Company.

Frozen Train Pipes, Their Cause and Prevention.

This was the second report presented at the Air-Brake Convention at Pittsburgh, in April. Extracts from the discussion of the first on "Roundhouse Air-Brake Work—Inspection and Repairs," were given last week, both reports having been published in the *Railroad Gazette* of May 9. Parts of the discussion of this second report follow:

Mr. E. G. Desoe (Boston & Albany)—It appears to me that no more important subject ever came before this Association, and it should especially appeal to those representatives from districts where water will freeze. It was demonstrated by the tests on the Boston & Albany Division of the New York Central and the New York, New Haven & Hartford that if the air is cooled to the temperature of the atmosphere before it leaves the last main reservoir, no condensation will take place back of the train pipe; but it is difficult to cool this air down on a locomotive to the temperature of the atmosphere before it leaves the reservoir. It was thought by your Committee if a pipe or a series of pipes be used on the locomotive as a cooler that this might be accomplished, and we did find that we could cool the air, but that in passing through the reservoirs it would re-heat. The result of that re-heating was to pick up moisture that had been condensed in radiating pipes and driven into reservoirs. Now it appears that the principal thing to look for is a cool location for the main reservoir. That is more important than the radiating pipe, but where we are going to find such a location on a locomotive is something I cannot say. I never believed in the location of the main reservoir on the tender, but I believe we will have to come to it if we are troubled with frozen train pipes. We may run up against other trouble, pipe freezing between engine and tender, etc., but supposing it does, it cannot result in the damage we get if it freezes back in the train pipe. Gardner D. Hiscox says there is seldom less than 50 per cent. of moisture in the atmosphere and it averages about 75 per cent. Air under compression is capable of holding as much moisture as the atmosphere at the same temperature, and no more. If saturated atmosphere at 32 deg. is compressed to 105 lbs. pressure, and leaves the main reservoir at 72 deg., and is cooled, back in the train line, to 32 deg., 50 per cent. of the moisture that should have been deposited in the main reservoir will be deposited in the train pipe, which will be frozen, and should a sufficient amount collect at any one point to completely fill the pipe we have what we term a frozen train pipe. If we would avoid the liability of a frozen train pipe, we must cool the air in the main reservoir or cool it before it leaves the last main reservoir to pass through the engineer's valve.

Mr. Weaver (L. S. & M. S.)—We have on our road a number of consolidation engines that are equipped with 11-in. pumps. The difficulty experienced at the beginning was that the hose would be burnt out between engine and tender. The main reservoirs are on the tender. They were put there for two reasons; on account of lack of space elsewhere and because of their weight. With those large pumps the hose burnt up and it became necessary to add a coil of pipe for the air to pass through to the main reservoir. Before this pipe was added we had considerable difficulty with the burnt hose. The precipitation of moisture between engine and tender in the burnt line would freeze. After we added this coil of pipe there was not so much danger of frozen train pipe, but the pipe would freeze where air entered main reservoir. We tried everything to obviate that. The Brooks Locomotive Works added a drain cup of their own construction, but that did no good. There would be more moisture precipitated in the train line when coupled to a train than there would be otherwise, showing that air from pump and main reservoir had not cooled sufficiently to precipitate the moisture, which passed through and precipitated in the train line. If the same engine were cut off from the train, there would be more precipitation between pump and main reservoir and in extremely cold weather it would freeze up at main reservoir. That was the only difficulty we experienced with location of main reservoir in that place, and I think, as Mr. Desoe has just said, if we cool the atmosphere before it enters the reservoir or train line, we will experience that trouble as long as main reservoirs are located on back end of tender. We have ordered from the Westinghouse Air-Brake Co. some reservoirs to be put alongside of the running board. They are about 12 ft. long and about 14 or 16 in. in diameter, two of them. We will connect them to the pump and have the air pass through them before passing through the reservoir on the back end of tender.

Mr. Andrews (P. R. R.)—In regard to not finding any water in auxiliary reservoir, I would say that within the last week I had occasion to inspect a Pennsylvania freight car that had flat wheels, and in doing so I found that the tube running from the triple valve through the auxiliary to the brake cylinder was bursted, and in the auxiliary reservoir we found three quarts of water.

Mr. Kelly (California)—The location of reservoirs on tenders would be bad practice. We are not troubled with cold weather and have two reservoirs. To keep the moisture in the reservoir and prevent it from passing to the train line, one reservoir is placed on the right-hand side of engine. It is made out of 12-in. casing and is set far enough away from the boiler to get no heat. It drops 2 in. from the pump, passes over the arch into reservoir No. 2 until it comes to the fire-box, then over the boiler again into train line, being connected with a T of larger diameter than the pipe. All reservoir connections pass inside from 5 to 6 in. as moisture adheres to whatever surface it comes in contact with. In that way everything is deposited in the reservoir and we very seldom find any water in any of the hose. The trouble with having reservoirs on the tank is that even if you do not burn the hose off, it is only a short time before the heat destroys the life of it.

Mr. Forney (Sou. Pac.)—I know very little about frozen train pipes because we work under peculiar circumstances. In California, Arizona and Mexico we have moisture but no very cold weather. In Utah, where we have cold weather, we have no moisture. The temperature in Utah goes to 35 to 50 below zero, but there is no moisture. To run successfully we apply a steam pipe to a section of the pump. We cannot keep the pumps lubricated without supplying some moisture; the lubricating oil will not go to the rear end of the pump.

Mr. Dowd—I come from a country where we have freezing weather. We have as low as 60 below zero. We are troubled with frozen train pipes. When possible we use six lengths of 9-in. pipe for reservoirs and allow the air to circulate from end to end. We have no moisture beyond the second length.

Mr. Greenwade—We had reservoirs on the rear of our tenders, holding 40,000 cu. in. of air, with one discharge pipe and no return pipe. It was impossible to get any moisture in these reservoirs at all, so we have changed and put the return pipe on the discharge end of the reservoir and now we get any amount of moisture in the reservoir and the temperature is the same as before.

(Continued on page 573.)

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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Last week *The Chronicle* published its report of railroad gross earnings for June and for the half year. The increase in gross for the half year was something more than 42 million dollars, for 152 roads having 173,000 miles. This is equal to 6.89 per cent. Of course, it is the more significant in that it follows heavy increases every year back to include 1898. The editor thinks that if returns could be had for all of the roads the improvement in earnings for the six months would reach 50 or 55 millions. On some of the individual roads the gains have been enormous; thus the Pennsylvania shows gains in gross for five months of 6½ millions, the Great Northern for six months 3¼ millions, the Canadian Pacific almost three millions, the Northern Pacific for five months 2 2/3 millions. For the month of June the gain was 7.16 per cent., which covers a period of diminished movement in grain, cotton and live stock.

At the last meeting of the Railway Signaling Club the representative of a prominent Western road said that his company had adopted a standard distance at which to place distant signals—the same being 2,500 ft. from the home signal; and that he had a great deal of trouble in keeping the wires to these signals properly adjusted. This led him to advocate electric apparatus for distant signals. Another Western man who spoke agreed that for so great a distance as 2,500 ft. it would be necessary to work signals by something other than the ordinary mechanical wire connection. These remarks indicate two significant things. First, that Western roads show an increasing appreciation of the value of the distant signal and of having it sufficiently distant to be of use to fast trains. Not long ago a Western signal man—connected, we believe, with the road here referred to—thought that distant signals were unnecessary, and said as much in a public discussion. Second, that the knack of working signals by 2,500 ft. of wire, while still keeping them well adjusted, is not easily learned; the second speaker seems to have looked upon it as impracticable. Yet, careful and experienced signal engineers have stated unreservedly that they do succeed in working distant signals regularly by wires, even farther than a half mile, and without compensators. Where is the source of the discrepancy in these views or statements? Here is an opportunity for a committee of the Railway Signaling Club to find out what the actual practice is in the different parts of the country, and to make a report showing where the best practice is to be found. We have now in common use three methods of working distant signals: (1) manual power by simple wire connection; (2) manual power and wire connection with compensator; and (3) power apparatus (at the distant post) controlled by electricity or compressed air. As far as the question now before us is concerned, interlocking plants worked by power may be left out of consideration; and also automatic signals. It is with ordinary mechanical interlocking, or with simple distant signals for small stations, that the question of adjustment arises.

With the first method above mentioned the difficulty is that wires will expand by heat and contract by cold so that the semaphore arm will not go to its proper position. Not long ago a collision occurred in broad daylight because a semaphore supposed to be in the stop position dropped about 10 degrees and was taken by the engineman to mean "proceed." We cannot see that the engineman had any reasonable excuse; but when arms are habitually left 5 degrees down for "stop" and when they are left about 30 degrees down for all-right as is the case at some places on "the best roads," it is not surprising to find enginemen taking chances. However, the signal engineer has no excuse, whether the engineman has or not. Signal inspectors who claim to avoid this trouble without using compensators should be given an opportunity to show the rest of the world just how they do it. With the second method, the trouble is with the expense of compensators. They do not give perfect satisfaction and so their cost is grudged. That they are unsatisfactory may be due to the maintainer rather than the designer, but that does not alter the fact that many signal engineers want something better. The compensator which gives the best service with the least care and expense ought to be given a certificate of character by a competent and impartial committee of signal engineers. We will venture, in passing, to whisper to any reader who may become a member of such a committee that if he expects to get from division superintendents thoroughly reliable reports of just how the signals do behave when the temperature of the atmosphere suddenly changes, he will have to be very alert; reports to superintendents sometimes conceal more than they tell. The third method is all right except the cost. We are not sure that a free gift of 50 electric-motor semaphores, for use as distant signals, would be a good thing in every place where such a gift could be used, for the simple matter of securing thoroughly competent electrical maintainers and inspectors seems to be too hard a problem for some roads; still, the immediate problem is one of cost. If an electric motor for the signal, with an electric wire to the cabin, could be furnished for $100 we should probably see a marked increase in the use of distant signals at once. If the signal companies wish to engage in missionary work, here is an opportunity. If they can reduce the price of electric motors and batteries so as to spread the use of distant signals they will not only benefit the railroads directly but will stimulate the demand for signals of all kinds and thus help themselves.

A rule requiring both trains to wait at meeting points (where both are of the same class) was formerly in vogue to some extent in New England and elsewhere, and it is still in use on the New York, New Haven & Hartford. It was the subject of a paper which was read before the recent meeting of the Train Despatchers' Association, and which is given, in abstract, in another column of this issue. The author of the paper makes two principal assertions: (1) that the New Haven rule is more convenient in every day practice, and (2) that it is just as good as the other rule in case of the failure of the telegraph. On the second point he ought to have cited the instances which he says will prove his contention, for most people will decide at once that he is wrong. If train No. 1 is wrecked at C and train No. 2 waits for it at D or F or H, and there is no telegraphic communication, both trains are "laid out," whereas if No. 2 were superior to No. 1 it could proceed. It could, perhaps, get to a point where telegraphic communications could be had; or it might be of material assistance to the disabled train. As to convenience in ordinary working it must be that differences in conditions would make differences in the results. For a large number of very slight delays the New Haven rule ought to be useful, especially with passenger trains. We judge that this condition is what has led to the retention of the rule on that road. It is an inheritance from the Old Colony road where it has been used many years. That road is made up of numerous short branches, rivaling the Long Island in the intricacy of its map. These short lines, with frequent stations, have many passenger trains and comparatively few heavy freight trains. Even on lines of this character we should suppose that it would often be more convenient to make the trains running toward the main line superior to those running in the opposite direction; but officers of the road say that the present practice is unquestionably superior to the A. R. A. rule. As the New Haven has over 1,300 miles of single track lines, and as this is a pudding that certainly must be provable in the eating, the judgment of the officers must be accepted as sound. With the spread of the use of the block system on single track lines, and the consequent probable introduction of the practice of allowing station men to change meeting points without consulting the despatcher, the rule under discussion ought to become more important rather than less so; for the less the trains are watched by the despatcher the greater is the necessity for having the most perfectly adapted automatic rule. What other road will take sides with the New Haven in this matter?

The Economics of the Brake.

Out of the mouth of babes and sucklings hast Thou ordained strength.—Psalms, 8.2.

We suggest this as a proper motto for the Air Brake Association, at least for a few years to come. Its appropriateness lies in two facts: The Association is the youngest of the important mechanical societies. It is teaching the superintendents of motive power, the superintendents of transportation, the general superintendents and the general managers a lot of things which they never knew before. No doubt those higher officers read carefully the reports and discussions of this youthful body. If they do not, they neglect an important part of their training in the progressive art of railroading.

This general art is made up of a multitude of subordinate arts, each of which may seem to its specialists as more important than any of the rest, but, in fact, it would be useless to try to estimate their relative importance. The effective use of the air brake is surely not the least important.

But this air brake art is not complete and closed-up as some of the higher officers seem to think. It is continually growing, just as is the art of signaling, or that of the design and use of locomotives. Day by day problems in the details of practice make their appearance and are met and settled by the men who have to run the trains and take care of the brake equipment. Further, it is at least doubtful if railroad officers at large yet grasp the real importance of the air brake as a part of the general machinery of a railroad. What we mean by such a broad statement will appear as we go on.

Signals have long been looked upon by most railroad officers as safety appliances only. Properly considered and properly used they are an essential element in the efficient and economical working of the whole machinery of transportation. They make it possible to move more trains over a given road, and to move them quicker. Thus, quite apart from their use in preventing accidents they help to the great end of making net revenue. That is, they permit, not only safer working, but more intense and efficient working of the whole machinery.

Precisely the same sort of thing will be found to be true of air brakes when they are used to the best advantage. It must be particularly noticed that we do not say when the brake as a brake is better than it is now, but when it is more intelligently used and more systematically and skilfully cared for. Generally speaking, this will apply considerably more to freight working than to passenger train movement. By and by, the man on an engine hauling a freight train will know that all the cars are fitted with air brakes, and that the brakes are all in order to work up to the theoretical standard of efficiency. Then, if we plot a speed curve of his run, we shall find that it is quite different from what it is now. There will not be so many high places and low places in the diagram, and the highest and lowest places will not vary so much from the mean curve. From this will follow several important things.

The highest speeds touched will not need to be as high in order that the schedule may be maintained, which means more tons hauled and less coal burned. That is, for a dollar spent in fuel and in wages more tons can be moved. It means also less danger of accidents of various kinds.

Less energy will be lost in repeated accelerations in speed, which again means more tons hauled in a train, less money spent for coal and for wages per ton hauled, and fewer break-in-two accidents.

From these conditions follows also less time lost on sidings, for the schedule will be better maintained. Here again is a saving of fuel and wages, and of interest on the investment in rolling stock. In other words, here is another element in the profitable use of the money spent.

An operating officer can satisfy himself that this is not a fancy picture if he will try to imagine the movement of passenger traffic over a crowded line

with the cars only partly fitted with air brakes, and with the same uncertainty as to the conditions of those brakes which he now finds in moving freight trains. He will appreciate at once that the present uniformity and regularity of movement would be impossible. Uniformity and regularity—uniformity in speed between the ends of runs, regularity in reaching meeting points, division points and terminals—are considerably more important in freight movement than in passenger movement. That is, they are more important elements of economy of operation, although not so important in immediate relation to the public. This proposition will be apparent if we consider carefully the sources of loss suggested in the paragraphs above, especially the loss caused by the limits to weights of trains which are fixed by the necessity of high maximum speeds and the necessity for frequently picking up speed.

If we are right in the idea that the highest theoretical efficiency in the use of the air brake in freight service is a valuable element in the total economy of operation quite apart from its use as a safety appliance, it follows that it is worth while to spend time and thought and money to secure that theoretical efficiency. Herein, it seems to us, is the great educational value of the work of the Air Brake Association. Those gentlemen are constantly discovering and making plain the details of practice on which time and thought and money can be spent to the improvement of the general practice. Thus the reports of their discussions become a valuable part of the literature of the profession which they are helping to build up.

Handsome reclining chairs are now run on the principal through trains of the Louisville & Nashville. This evidence of the enterprise of the passenger department of the road is noted in the Traffic Column. But there was one point that we did not note there—the race question. In every Southern State this troublesome question of unnecessary expense seems to be always ready to bob up. For years we have been commiserating some of the English railroads because they were so short-sighted, or so unfortunate, as to run six classes of cars in a single train—first, second and third classes for non-smokers, and the same for smokers. A large unnecessary waste of seats is inevitable. But while the English are attempting, and with some success, to reduce the number of classes, our Southern friends are increasing it. The public down that way demands whatever may be dictated by its fancy—temporary or otherwise—and the railroads must comply as best they can. The way in which the new cars have to be dealt with is indicated by the following from the *Montgomery Advertiser*:

"From Cincinnati to Montgomery this car is exclusively for white passengers, a Chicago coach being put on for the colored passengers. In the Montgomery shed, however, poles and curtains [are put in to] form a portière in one end of the car, that end being shut off for colored passengers. Now the end reserved for the colored passengers is the end of the car that has the lavatory and smoking room, and to reach this lavatory white passengers are compelled to go through the colored compartment; this between Montgomery and Mobile."

The alternative seems quite plain; six separate cars, or else constant disregard of the letter of the law. Two chair cars for through passengers, two "coaches" for the way travel (for which chair cars would be an unwarrantable luxury) and two smoking cars. As to the spirit of the law, it is difficult to say what it is, for the different States treat the matter so differently, and the people so often seem to act as though the law were an annoyance instead of a benefit. Perhaps, if the present variety of practice continues, the majority of the people will after a while be able to agree on what they desire; and on a reasonable requirement. At present we have (1) separate cars; (2) cars with wooden partitions; (3) cars with curtains, and (4) cars with an invisible division—an order, by placard, for whites to sit as far as possible from one end and blacks to sit as far as possible from the other. Some of the legislators who help to make the laws prescribing these requirements ought to be compelled to share the trainmaster's perplexities for a while.

The fall of the Campanile of St. Mark's, at Venice, on Monday morning of this week is an engineering event of great interest. According to the Encyclopædia Britannica this was a brick tower 42 ft. sq. at the base, rising to a height of 325 ft., including the lantern and pyramidal roof. Baedeker makes the height 322 ft. The dimensions of the tower at the top are not given, but the taper was small. The builders dug down to stiff clay and drove poplar piles 10 or 11 in. diameter close together over the whole area of the foundation. The dimensions of this area we do not find, but from the cut in the Britannica the spread looks small considering the great height of the tower. However, the tower has stood seven and three-quarters centuries. On the piles are two courses of oak timber, on which are five courses of rough blocks of trachyte, or porphyritic stone, and on these six courses of the same stone, dressed. From these rose the brick tower. In 1885 the foundations were examined and the piles and timber were found to be sound. The structure was begun in 900 (Britannica) or 911 (Baedeker) and the main tower was finished in 1131. Late in the 16th century the statue was added, completing the structure. The tower was severely simple, its beauty being in its dimensions and its proportions. On Sunday of this week a crack was found in one corner and two windows were broken. This seems to have been the only warning. Doubtless the foundations will be examined; but unless the cause of the fall is found there it may remain forever unknown. Until we get more information guessing seems useless, and yet the engineer cannot help casting about in his mind for possible causes. The channel in the vicinity of the tower has lately been dredged and the conjecture has been advanced that this may possibly have affected the foundations. The Washington monument is 70 per cent. higher than the Campanile and 71 per cent. larger in the *area* of the base of the shaft, but only 31 per cent. wider on the face at the base.

The lively manner in which the Illinois Central, Big 4 and 3-I railroads Sunday and Monday night skirmished about to get rid of freight cars belonging to other lines would have done credit to the players in a game of "hearts." There was an important reason for their eagerness to get the cars off their hands. . . . This paragraph, from the Kankakee *Times*, is a sample of similar paragraphs which have been, or might have been, written at many cities about the fourth of July. It is not necessary, however, for the reporter to visit the railroad yards in the night, when the approach of the hour of twelve makes the motions of the yard men more active; he can get evidence of the effect of per diem simply by watching the trains as they pass any station. Railroad officers all around the country are remarking the large proportion of home cars observable in their freight trains. So much for surface indications. Permanent good results are also appearing in many places, as has already been noted in these columns. Numerous roads doing business in cities where there have long been demurrage associations, but which have not joined the associations, are now coming in; as, for example, the Long Island Railroad, at New York city. Terre Haute is to have a demurrage bureau of its own. At a number of smaller places demurrage is being collected on a business-like basis for the first time. That some shippers and consignees are being "squeezed" goes without saying. At Moline, Ill., the factories "are experiencing all sorts of trouble." In Iowa, certain coal miners say that they are likely to have to close their mines unless they can continue the practice of putting their coal on to the cars as soon as it comes out of the ground—which, of course, means the frequent shipping of the coal before the consignee is ready to receive it, or before a consignee has been found. We have before noted one or two cases where a railroad is going to make the consignees bear their fair share of the burden of the new charge. We now hear that the Chicago & Western Indiana, which controls the Chicago Belt, has put the car service charges on its tariffs, and proposes to collect them in and with the switching bills. The Grand Trunk and the Canadian Pacific are going to add 20 cents a day to their present nominal charge for stopping off cars of bulk freight for inspection, for changing destination, etc. A firm in eastern Pennsylvania, which receives large quantities of bulk freight, has notified its shippers that car service charges due to the fault of the shipper will be charged back to him.

Mr. H. F. Campbell, heretofore of the Transportation Department of the Pennsylvania Railroad, has been appointed Secretary of the Arbitration Committee of the American Railway Association, which will have to do with such differences between railroads concerning car service as cannot be readily settled by the parties in interest. We understand that Mr. Campbell's office will be at Baltimore (B. & O. R. R.), which is the headquarters of Mr. Hale, the Chairman of the Arbitration Committee.

Frozen Train Pipes, Their Cause and Prevention.

(*Continued from page 571.*)

Mr. Burton (Cen. of N. J.)—We have a class of passenger engine with main reservoir on back of tank, capacity about 50,000 cu. in., and a frozen train pipe on these engines was unknown, but the discharge pipe would freeze where it enters the main reservoir. The reservoir being on the extreme rear end of the tender, where the discharge pipe passed up on the rear of the tender, it went up through a flue surrounded by water, and when it entered the main reservoir, it was at almost the same temperature as the outside air. If we cut the pipe loose after making a round trip from Jersey City to Philadelphia, we found the pipe would freeze, and in about three round trips it would freeze up hard. To overcome this we connected the discharge pipe between the engine and tender, coupled on to the discharge pipe and brought steam through the rear end of the main reservoir, and we had no more trouble.

We have never had a discharge pipe freeze, but we have had frozen train lines. By putting on second reservoir, it practically did away with this. On this class of engine one reservoir is about 6 ft. from the air pump. The second reservoir is as far away as we can get it and keep it on the engine. We have practically no trouble from frozen train pipes if they are properly blown out.

The report says there will be no trouble from accumulation of water in the train line if the air pressure in the main reservoir is cooled down to the temperature on the outside, regardless of how much moisture has passed in. My experience is that it depends largely on how connections are made to the main reservoirs. I have seen pipes frozen where the pump was connected to the discharge end. If you want to get steam in through the pumps, the train line connections will have to be made accordingly.

Mr. Desoe—I do not think it is clearly understood what the committee has said in regard to cooling the air down. When the steam was being taken in at the section of the pipe the reservoir was piped with, and came out of the pipe leading to the engineer's valve, the temperature was not reduced. We admitted a jet of steam and it was no small jet either. We cooled the air down to the temperature of the atmosphere and not a particle of moisture appeared in any place, and yet we were admitting large quantities of steam to the pump. In regard to placing the main reservoirs on the tender, there seem to be two opinions; one that the hose will give out frequently by being heated; the other that the pipe will freeze where it enters the reservoir on tender. They can both be overcome. The first by using metallic connections instead of hose, and the second by covering the pipe.

Mr. J. N. Smith—We are using about 25 metallic connections and they are working very nicely.

The President—We have several and find they are doing excellent work.

Mr. Weaver—We tried in train line covering the pipe to prevent freezing, but owing to location on back end of tender, the discharge pipe having to pass through the tube on the tender, it gave little opportunity to put much covering on. When we first received the engine there was no difficulty experienced in the discharge pipe freezing up, but there was difficulty in burning up the hose. After we had the coil put on the difficulty was transferred from a frozen train line to a frozen discharge pipe. We covered it all we could but that did not do any good. After we put on the coil of pipe, the air was cooled until it was nearly at the temperature of the surrounding atmosphere, and then moisture would adhere to the wall of piping and would freeze rapidly.

Another thing we noticed was that it depends a good deal upon the number of cars in a train as to the amount of moisture precipitated in train line. The longer the train, the less difficulty will be experienced with frozen discharge pipe; with short train we get it quite frequently and in several instances the pump stopped on the road.

Mr. I. H. Brown—This question first came to my notice when we were having a great deal of trouble with frozen quick action triple valves on tenders. First we thought that this freezing was caused by moisture passing back into the train line. Some thought it was caused by steam. The engine was a compound with the air inlet very close to piston and valve stems of the engine on the left side. The engine was fitted with single reservoirs, with the pipe passing out close to the discharge pipe, up to the brake valve. We added two reservoirs, putting the second one on the engine, and connected the discharge pipe to a connection inside of reservoir, allowing that connection to be 7 in. from the bottom of the reservoir, which was 26½ x 40 in. The first trip we did not take the precaution to blow out the train pipe and in looking it over we found an accumulation of frost.

Mr. F. B. Farmer (W. A. B. Co.)—The question seems to be one of getting pipe between pump and main reservoir, with the latter on the tender. It has occurred to me that possibly you might locate it in the tank, and to prevent any trouble from freezing have a by-pass valve to the cut-out cock. Also that this sort of a reservoir might do in moderate winter weather, but not when the temperature is low enough to use the heater very much. On the other hand, when the heater is in use you would certainly guard against freezing between the pump and main reservoir.

Mr. Weaver—When we first obtained these engines I spoke of there was no drain cup on the pipe leading to main reservoir. After we experienced the difficulty of freezing, we added a drain cup to the pipe where it led up to the main reservoir. This drain cup was designed by the Brooks Works for this trouble. I suggested putting a reservoir down at the lower part of the main reservoir and connecting it to the main reservoir to catch the precipitation. The Brooks people put this drain cup on both sides, but it did not prevent the freezing, as the pipe froze above that, where it passed up through the tank. The moisture would keep adhering to walls until it would close the pipe. You could drain it, but it would still freeze up, and invariably when coupling on to train.

Mr. Farmer—It is evident that the drain cup did not get all the moisture out and if it did the flow of air carried it off. If the moisture were cooled in the tank water, it would be converted into water, not as frost accumulating in the pipe, but it would be heated enough to prevent precipitation before reaching the main reservoir.

Mr. Gansen (P. C. C. & St. L.)—During the cold weather it was my duty at Columbus roundhouse to inspect air apparatus on passenger engines, and also to look after the main reservoirs. During very cold weather I got no water from the main reservoirs to speak of. The inside of train line was where it would freeze, and when I opened the engineer's valve it would look like a snow storm. Two wrecks were caused on the Indianapolis Division by frozen train pipes. I heard of several train pipes freezing when they did not have any leak, and found out that the engines are fast freight engines, on every one of which the pump and engineer's valve are on the same side of engine and connected to the right main reservoir. They have second reservoir on the left. The pipes are connected within 4 in. of the pipe to the engineer's brake valve. Running along the road you get mostly frost in your train line. I do not think you can stop up the train line with frost, but as soon as the engineer

makes an application and the pump starts to running hard, it heats the air and melts this frost. A half cup of water may be in the train line and will settle at lowest point, and in two minutes will be solid. The first time it reduces the size of the hole, the second may close it up and the next time the engineer tries to draw the train line, it is frozen up. To overcome this trouble the air must be taken from the other reservoir.

Mr. F. M. Nellis (Loco. Eng.)—I do not believe due credit has been given the committee for finding the importance of an additional pipe between pump and main reservoir. They have struck the keynote when they advocate more pipe between pump and main reservoir, and if we do that we will have very little if any water going back into the train pipe. There are other minor conditions, but the most important one is greater length of pipe between pump and main reservoir. I think the committee's investigation goes to show that the larger a main reservoir is made, the more liability there is of moisture being deposited in it, and it is a matter worth giving consideration to.

Mr. L. N. Sherman (L. & N.)—On the road that I represent we have main reservoirs in different positions. Some are under the running board, some on top of the boiler and some between the frames. Most of the passenger engines are equipped with main reservoir between the frames. We experienced a little trouble last winter, but not on passenger trains. We experienced more trouble with passenger engines that had one reservoir underneath the running board than with any other class. I know of but one case where we had any trouble with frozen train pipe, with main reservoir on top of the boiler. Where one main reservoir was underneath the tender we did have a great deal of trouble with the discharge pipe freezing up, but very little trouble with train pipe freezing.

Mr. Forney—The method we pursue to get rid of water is to put two reservoirs on an engine, one under each running board, 16 x 110 in. If the pump is on the right side we drop the discharge pipe. We take the circulating pipe under back and put it in there; then we take the brake-valve to back end of the reservoir. In that way we do away with all water. We drop the discharge pipe over to the right reservoir and the brake-valve pipe across the boiler head. In that way we get about 9 or 10 ft. of discharge pipe between pump and reservoir. If water does not go through the brake-valve it is not going to freeze up.

Mr. F. C. Whitney—The engine that we made these two tests on was piped almost exactly as Mr. Forney described. The air does not get down to the temperature of the atmosphere. We found it was impossible to get the air below 100 deg. In the way the reservoirs were placed on this engine, we found water in reservoir No. 1 and no water in reservoir No. 2, but water in the drain cup underneath the tender. We had a glass tube between the engine and tender and another at the rear of tender. The air would leave the last reservoir at a temperature of 100, passing down through engine and tender; the glass immediately clouded and beads of water started to form. The glass tube at the rear of the tender was clear, and remained that way for about one hour. After that hour had passed we went back there and saw a drop of water come down to the tender. Shortly afterwards another one came down and still another one. I put a thermometer between the engine glass and condensing tube and the temperature was 50 deg. The outside temperature at hose of rear tender was 72 deg. The temperature of air passing through train pipe at rear of tender was 66 deg.

Mr. Weaver—Where the main reservoir is on the tender I would put inside of the tender a coil of pipe from one main reservoir to a second one. I think that would do away with water in the train pipe. I make this suggestion from a little experience we had at Buffalo shops.

Mr. C. B. Conger (International Cor. Schools)—We have not heard anything about keeping the water out of testing plant. I think while we are talking about it, we ought to discuss measures to keep it from getting into testing plant.

Mr. Coggin—I would not have said a word on this subject were it not for question brought up by Mr. Conger. I have in mind one of the largest terminals in this country where the switches are operated by compressed air. It is in a pretty cold country, too. A great deal of trouble was experienced with condensation and freezing up in cylinders and valves. There was condensation enough carried along in the pipes to freeze some of the valves in extreme cold weather. The suction was taken in from outside, almost directly over salt water where it was foggy, and brought in to a clean, clear, warm room, and that helped the trouble to some extent, but it did not overcome it. They did overcome it by putting up a large radiator, some 25 ft. high, and I presume 15 to 20 ft. in width, and all of the compressed air is put into that radiator and cooled down.

Train Despatchers' Convention.

The convention of the Train Dispatchers' Association at Pittsburgh was reported in the *Railroad Gazette* of June 27, page 511. Following are extracts from some of the papers read at the convention.

DEFECTIVE TRAIN DESPATCHING.

By H. A. Dalby (C., R. I. & P.).

While this topic has been discussed for many years at impromptu meetings of the Round House Club and the Caboose Committee, and many who have taken the most active part in these deliberations have been those who knew the least about it, yet we may recognize some indebtedness to these unofficial and irregularly called conclaves, for bringing out some truth. There *is* such a thing as defective train despatching. There may be several causes for these shortcomings, particularly two: Lack of knowledge of the road, and lack of judgment. The despatcher should have a knowledge of the grades and locations of stations and sidings, and a knowledge and understanding of the tonnage system of handling freight. The despatcher should know not only the rating of each engine, but that of each conductor and engineer as well. It is quite as essential to know the man as the engine. The scope of useful knowledge extends also to machinery. While a despatcher cannot be an expert in this line, it is a great help in case of a breakage if he has an idea of the extent of the damage, or how long it will require to make the repairs. This knowledge may be useful in making intelligent reports to the trainmaster or superintendent.

This knowledge cannot be obtained by sitting in the office looking at a train sheet. The despatcher should ride over the road as much as possible; on a freight train, if convenient, and frequently on the engine. It is of great advantage for the despatcher to know personally every conductor, engineer and operator with whom he has to deal. Some roads require a despatcher, before going to work, to go over the road several times and pay him while thus learning the duties. Some roads require despatchers to go over the road while off duty or "double," and work for each other if they have not time of their own. The requirement to "double" is wrong. Eight hours' actual work in the office, every day in the year, is quite enough. If a man is required to be on duty 12 hours, the work of the last two or three hours, as a rule, is not up to the standard. The brain becomes tired and inferior work is the result.

Several years ago there was an office on a road which in some respects might be termed "first-class," where two of the despatchers were required to "double" while the third went over the road. The work was such that a man had no time to read the newspaper or tell funny stories while on duty. He was responsible for so many things outside of train movements that he was required to report 30 minutes before the time of going on duty in order to acquaint himself with the situation before sitting down to the sheet. He seldom got away in 30 minutes, and it was often an hour, from the time he was relieved, so that when he was nominally working 12 hours his actual time of service was from 13 to 14 hours. As a consequence the work was far from perfect, and going over the road was looked upon as a dreaded duty. It would be to the interest of our employers to make it possible for the despatcher to go over the road once in a month or six weeks without loss of sleep or pay and without the necessity of working overtime to pay for it.

Poor judgment often delays trains. No one is more ready than the writer to defend the despatcher when criticisms are made as to his "poor judgment," but sometimes the criticism is just. The familiar delay of "getting orders" should be reduced to the minimum, for the reports of such delays are sometimes stretched to the maximum. A train should not be stopped for orders if the movement can be anticipated. When it becomes necessary to stop a train for orders it should be at the place where the least delay will result. Here is where a knowledge of the road is of value. The grade at the station and the view of the order board will enter into such consideration.

The manner of sending orders calls for considerable judgment on the part of the despatcher. Within the past year there have been many cases of a debate between conductor, engineer and despatcher as to how an order should be acted upon. This causes delay.

Orders are issued for engine 45 to work extra until 7 p.m. and meet No. 82 at a certain point. The work extra does not appear by 7 p.m. and what should No. 82 do? Go or stay? An order was issued for an extra to run ahead of No. 27. No. 27 and No. 28 were given orders to meet at Pittsburgh. The extra could not make Pittsburgh for No. 28 and stopped at Harrisburg. What was No. 27 to do? It could not pass the extra, the extra could not go to Pittsburgh, and No. 28 could not leave Pittsburgh. The despatcher should have avoided the situation.

In these two orders there is a bad mixture of the positive and the conditional. In the first instance No. 82 had orders to meet the work extra. There is but one way that trains can meet, and that is by being at the same place at the same time. This is the positive clause. The work extra's order is limited to a certain time, after which it ceases to exist. This is the conditional, and there is no rule in any code that will determine whether No. 82 should be governed by the positive or the conditional in this case. The same faulty combination exists in the second case.

It is poor policy to put a number of movements in one order unless any one of them can be superseded or annulled in a few words. Long orders require a long time to issue. An order was issued that "No. 27 will wait at Harrisburg until 12:20 p.m. and at Pittsburgh until 12:40 p.m. for extra 798 east, and will run 35 minutes late Pittsburgh to Columbus." It was found necessary to annul the "waits" at Harrisburg and Pittsburgh and the annulling order had to read like this: "That part of order No. 72 reading 'will wait at Harrisburg until 12:20 p.m. and at Pittsburgh until 12:40 p.m. for extra 798 east' is annulled." How much easier to have put the "waits" in a separate order and then to have said "Order 72 is annulled."

To get trains over the road with the least delay is a study. It cannot be done without close attention. Train movements cannot be jumped at, haphazard. The situation must be carefully considered from all points of view.

. . .

THE TRAIN DESPATCHER—SOME CRITICISMS.

By S. H. Brown (C. & A.).

Mr. Brown gave examples, some of them amusing, of train orders issued in the old days, and of cases where meeting points were made by word of mouth. Continuing, he said:

From the old-fashioned single order through various stages of double order practice, the Standard Code of the present has been evolved. There have been so many corrections made in the code, however, and so many modifications to suit the particular ideas of individual officials; such an abundance of "rulings," that to-day we have an assortment of "standard" rules with no two roads using exactly the same code; and an elaborate variety of constructions placed by different people upon the same rule. The question arises whether there has been much benefit derived from the use of the Standard Code.

Upon some lines it is held that a train overtaking another train of the same class requires an order to pass. The reverse is the case on other roads. The only authority I find in the rules is by inference. Rules which do not make their meaning entirely clear are bad rules. The rules are always available. The rulings upon the rules are not. This order is in more or less general use upon American Railway Association lines: "No. 3 will pass No. 1 when overtaken." What right does this indefinite order confer that should not already be conferred by the rules? The nonsense of wasting time that might be more profitably expended should be avoided. Whether it is the fault of despatchers now in that service or those former despatchers now in official positions, I am not prepared to say; but this I know—the duties of despatchers are becoming so irksome that the limit of safety must soon be reached.

The writer has directed his humble efforts, of late years, to calling attention to several points that may safely be corrected. . . . Despatchers are daily and hourly interrupted during the transmission of orders, by operators signing other orders to get "complete," or to ask for clearance for other trains. These and various other interruptions upset the despatcher's thoughts for the instant. They are an annoyance. The standard of discipline existing among the men while working on the wires is proverbially bad. The chief despatcher (an official who, upon most roads, is overloaded with duties) receives complaints against operators and knows that they should be remedied; but his other cares absorb so much of his time that, aside from a perfunctory letter to the miscreant, no action is taken. The despatcher should be clothed with power to enforce his wishes. The chief despatcher is not half as much interested (directly) in what operators do as his agents; but usually he has no direct jurisdiction over the latter.

The train despatcher of the future will be provided with a reliable train wire. It will be inexcusable to leave the wire open. All business except train business and movements incidental thereto, will be excluded from it. No signal will be superior to that of the despatcher and his lieutenants. Operators will send "Morse." Time-tables will be for advertising purposes only. Train rules will be few and explicit. Each train will move, so long as it is given clear signals, without regard for other trains. No operator will give a clear signal until authorized by the despatcher.

In case of wire failure, trains will move from block to block by direction of operators until communication is restored. There will, however, be less wire trouble, as line repairers and others will cease to treat the wires as of little consequence. Operators will be taught how to make patches and do such other wire testing as the service demands. Less than 10 per cent. of the operators now in railroad service can make the simplest patches. Handling trains by the slow, cumbersome and *unsafe* method of carbon and manifold orders must become obsolete.

"THE POSITIVE MEET."

Mr. E. M. Woodruff, of the New York, New Haven & Hartford, presented a paper advocating the plan of having trains of the same class wait indefinitely for each other at regular meeting points, which plan has been in force on his road for many years. The ordinary practice, under which one of the trains is not required to wait (the other, if late, waiting at another station, if necessary, to keep out of its way) requires the despatcher, also the crews on the inferior trains, to constantly figure on their meeting point with the next opposing superior or equal class train. There are cases where the inferior train requires an order every day to reach its meeting point when running practically on time. When trains are running late, this rule often compels the despatcher to issue an order to two approaching trains when they are 50, 75, or even 100 miles apart. With the New Haven rule all rights between trains of the same class are equalized, and both trains can make the meeting point without a thought of train orders by anyone concerned, even if one or both trains are running a little late. The argument that in case of wire trouble this arrangement ties up more trains than the Standard Code is wrong. If the two systems be applied to various

situations, it will be found that where one system ties up a train the other does not, and vice versa. There is nothing more advantageous to be said of one system than the other in this connection, as has been satisfactorily proved in actual service.

Oil Sprinkling on the Santa Fe.

The Atchison, Topeka & Santa Fe is using oil on the track to keep down the dust on portions of its lines west of the Colorado River, in Arizona and California. Altogether some 600 miles of road has been treated. The branches, and mileages for each are: Southern California, 100 m.; Santa Fe & San Joaquin Valley, 200 m.; Santa Fe Pacific, 300 m. Also a short stretch of 13 m. in Texas has been sprinkled experimentally.

On the Arizona and California lines mentioned, and particularly in the San Joaquin Valley, the ballast is nothing more than sand and dirt and as a result traveling over it at this season of the year has been far from pleasant. The Santa Fe begun experimental applications to parts of the system in this section several years ago; extensive application was begun last year. Results are reported to be entirely successful and highly satisfactory.

The average number of barrels of oil required per mile is 40; there being 42 gal. to the barrel the number of gallons to the mile is 1,680. The cost is $11 per mile. One application a year is all that is needed to keep the dust down. There has not yet been time to observe other benefits such as preservation of the ties and eradication of weeds.

Crop Conditions on July 1.

Preliminary returns to the Government Statistician on the acreage of corn planted indicate an increase of about 3,520,000 acres, or 3.9 per cent. on the area harvested last year. The average condition of the growing crop on July 1 was 87.5, as compared with 81.3 on July 1, 1901, 89.5 at the corresponding date in 1900, and a 10-year average of 89.2. The condition in Illinois was 91, in Iowa, Nebraska and Indiana 90; in Kansas and Oklahoma 99, in Missouri 102, in Ohio 87, and in Texas 41.

The average condition of winter wheat improved during June nine-tenths of 1 point, standing on July 1 at 77, or 11.3 points below the condition on July 1, 1901, 3.8 points below that at the corresponding date in 1900, and 2.4 points below the 10-year average. The average condition of spring wheat declined 3 points during June, standing at 92.4 on July 1, as compared with 95.6 on July 1, 1901, 55.2 at the corresponding date in 1900, and a 10-year average of 85.8.

The average condition of the oat crop on July 1 was 92.1, as compared with 90.6 last month, 83.7 on July 1, 1901, 85.5 at the corresponding date in 1900, and a 10-year average of 87.3.

Chicago Freight Handlers' Strike.

The strike of the freight handlers in Chicago proved serious and persistent. Strong influences were exerted on the second and third days of the strike to bring the opposing forces into agreement. The Mayor of the city, the State Board of Arbitration and the Executive Committee of the Chicago Federation of Labor, as well as the Chicago Board of Arbitration through its Chairman, used their good offices, and each General Manager saw a committee of five of the men from his own road. It was reported Thursday that a settlement had been reached, the terms being the scale of wages which we gave last week, and various other points regarding hours, holidays, etc., but the President of the union induced the men to reject the proposition, so that all of the previous day's work went for naught.

However, two roads reached a settlement with their men, viz.: The Illinois Central and the Wisconsin Central. A committee empowered to act had a conference with the proper officials of the Illinois Central and an agreement was signed by the chairman of the committee of the freight handlers and representatives of the road, the agreement being practically the same as that referred to above. But in the meantime it became apparent that the teamsters could not be restrained much longer, and on the strength of these indications the men immediately repudiated the agreement negotiated by their committee. This is said by the Illinois Central to be the first time that its employees have failed to abide by an agreement made with the company by properly accredited representatives.

After the refusal of the freight handlers to accept the terms offered by the General Managers, the former entrusted their interests to the Chicago Board of Arbitration, agreeing to abide by whatever arrangement the board should make. The roads, however, declined to arbitrate, claiming they had already offered every inducement to effect a settlement that the situation justified. The board labored for a settlement and induced the union to recede from its stand that it would treat only as a general body, and it agreed once more to send committees to the various roads to seek a permanent settlement. The terms this time were to be the scale submitted by the roads, with the exception of truckers' wages, which were to be 18 cents instead of 17, and there was to be no period of probation for new men. But the roads refused to give the extra cent to the truckers. The committees dropped to 17½ cents, but still the roads declined to yield and the conferences ended.

A general appeal was at once issued to all freight handlers, lake or railroad, all teamsters carrying freight and all switchmen on the roads having terminals in Chicago. The teamsters and longshoremen responded and the situation became the most serious since the beginning of the strike. The ice drivers' union refused to haul ice to the roads, leaving all freight cars and cold storage houses without ice. The wholesale trade of the city came to a standstill and freight accumulated in the inward freight houses of the various roads. Perishable freight spoiled. Merchants having freight of this kind in transit for Chicago sent out telegrams to have it diverted and disposed of in the best way possible.

Encouraged by the support of the teamsters and longshoremen the freight handlers returned to their original demand of 18 cents for truckers. The railroads appear to have secured more or less adequate forces of new men for their freight house work; but with the blockade due to the teamsters' leaving their work the new men in the freight houses did not have much to do.

On Tuesday of this week it was said that four roads had entered into agreements with their men: the Lake Shore & Michigan Southern, the Chicago & North Western, the Nickel Plate, and the Illinois Central. Of the four, the North Western and the Illinois Central accepted the proposition made upon advice of the Board of Arbitration. The Nickel Plate and the Lake Shore succeeded in getting their men to sign the scale presented by railroads July 1.

As we go to press (Wednesday) the press despatches say that the men have voted by a large majority to give up the contest and have applied for their former jobs; thus indicating a complete victory for the railroads. The teamsters also went back to work.

TECHNICAL

Manufacturing and Business.

The general offices of the Chicago Pneumatic Tool Co. have recently been removed to the Fischer Building, Chicago, where the whole tenth floor is occupied.

G. W. Taylor, General Foreman of the Chicago & Alton at Brighton Park, Chicago, has resigned, to accept a position with Torbert & Peckham, Chicago. A. McGregor succeeds Mr. Taylor at Brighton Park.

The Union Railway Supply Co. has been incorporated in New Jersey to make railroad supplies; capital, $75,000. Incorporators: H. E. Woodman, C. E. Pugh, Philadelphia, and A. M. Worstall, Millville, N. J.

Westinghouse, Church, Kerr & Company announce the removal of their Pittsburgh office from the first floor of the Westinghouse Building to more commodious quarters on the eighth floor of the same building. This is the outcome of largely increased business in the district.

The Ashcroft Manufacturing Co., 85 Liberty street, New York, are informed that the Tabor steam engine indicator has been adopted by the Philippine Insular Government as standard on Class "A" cruisers, 15 of which have been equipped with these indicators.

The pipes in the plant of the Tesla Laboratory, Wardenclyffe, Long Island, N. Y., were recently covered by the H. W. Johns-Manville Co. The covering used in this instance is the Asbestos-Sponge felted sectional pipe covering made of fibers of asbestos and a small quantity of granulated sponge, thus combining the properties of asbestos with the lightness and porosity of sponge.

The Industrial Water Company, 126 Liberty street, New York, has just closed a contract with the Procter & Gamble Company for the installation of a water softening and purifying machine to treat 35,000 gallons of water per hour. This machine is to be installed at the factories at Ivorydale, Ohio, where for more than a year past a smaller machine has been successfully treating the same water.

The Hayden & Derby Manufacturing Co., 85 Liberty street, New York City, are told that the Metropolitan 1898 injector, model "O," has been adopted by the Philippine Insular Government as the standard on the class "A" cruisers, 15 of which have been fitted with these injectors. The contract was secured by F. W. Horn & Co., Yokohama, Japan, who are the agents for The Hayden & Derby Manufacturing Co. at that point.

The Philadelphia Pneumatic Tool Co. has established an agency in South Africa, with headquarters at Johannesburg. It will be in charge of Gen. Samuel Pearson, late of the Boer forces. General Pearson has been in the United States for some months in the interest of his government, in the attempt to have the mule shipments from Port Chalmette stopped. Now that peace has been declared he will return to his former business in machinery lines and will handle the accounts of the Philadelphia Pneumatic Tool Co. and others. Before coming to America General Pearson saw much active service in the field, and for a time was in charge of railroad traffic.

Iron and Steel.

The Atlanta Rolling Mill & Tin Plate Co., with $250,000 capital, has been organized to operate in Atlanta.

The Maryland Steel Co. is about to ship from Sparrows Point to San Francisco, by the new steamer "Tremont," 3,000 tons of rails.

It is said that the Lackawanna Steel Company's plant, now building near Buffalo, will be ready for operation about Jan. 1.

The Stamford Engine & Machine Co. has been incorporated in New Jersey, with $250,000 capital. The temporary address of the company is 75 Montgomery street, Jersey City, N. J.

The property of the Troy Steel Co., Troy, N. Y., will be sold at auction at the City Hall, Albany, Aug. 7, to satisfy a judgment in favor of the Guaranty Trust Co. of New York, trustee of the bondholders. The plant has been idle for a long time.

The Risdon Iron Works is about to issue $600,000 of bonds. Since purchasing the plant of the Pacific Rolling Mills adjoining the Union Iron Works, many changes and improvements have been made and the work of ship building and repairing has been inaugurated.

The Cope Bridge Co., of Hamilton County, Tenn., has been chartered in that State with $10,000. Those interested are Francis Cope, Oliver J. Cope, Carroll T. Cope, Walter B. Cope and John O. Byrd. The company already has contracts for a large number of bridges in Green and Campbell Counties, Tennessee.

Jas. Ross, President of the Dominion Steel & Coal Co., in an interview, said the Steel Company was turning out more product now than ever, and at much cheaper cost. Large shipments were being made to the United States and to different parts of Canada. There are now six open hearth furnaces in operation, and the daily output of steel averages about 400 tons.

Steel Trade in South Africa.

JOHANNESBURG, Transvaal, July 11.—The British Trade Commissioners, who recently arrived here from England, admit that they are amazed at the amount of business in steel building material which is offering and comment on the indolence of the British firms. They say that so far as they are able to discover, only one firm, and that an American concern, has a capable representative in South Africa, and he has been securing immense orders in Cape Town and at Johannesburg, at his own prices, for huge buildings up to 14 stories, by being able to quote prices promptly and promise construction with American speed.

The Corrington Air Brake Company.

This company has been organized under the laws of the State of New York. The list of officers and directors is as follows: J. N. Beckley, President; Chas. Hansel, Vice-President; Murray Corrington, Vice-President and Secretary; Solomon Hanford, Treasurer.

Directors: J. F. Alden, Rochester, N. Y.; K. W. Blackwell, Montreal, Can.; Frederick Cook, Rochester, N. Y.; C. F. Gehrmann, New York; Chas. Hansel, New York; Jos. Larocque, Jr., New York; Elias Rogers, Toronto, Can.; J. N. Beckley, Rochester, N. Y.; Wm. G. Choate, New York; Murray Corrington, New York; S. Hanford, New York; C. A. Hope, New York; J. P. O'Donnell, London, Eng.; Nelson Shipman, New York; H. M. Watson, Buffalo, N. Y.

Executive Committee: Chas. Hansel, Chairman; J. F. Alden, J. N. Beckley, S. Hanford, Murray Corrington, Secretary.

A Harbor Contract.

The Navy Department has let a contract to the Massachusetts Contracting Company, of Boston, the lowest bidders to remove about 350 ft. of Henderson's Point, in the harbor of Portsmouth, N. H., for $749,000. This point has been a menace to navigation and its removal will permit the largest battleships to reach the Portsmouth Navy Yard.

The Naval Appropriation Bill.

The Naval appropriation bill carries $79,351,238. The new ships authorized are two first-class battleships, two first-class armored cruisers and two gunboats, and at least one of the battle ships must be built in a Government yard. An appropriation of $175,000 is made to equip each navy yard which may be used for building any of the ships. For improving the new naval station at Charleston, S. C., $500,000 is allowed, and for a fireproof building at the Pensacola, Fla., Navy Yard, $100,000 is appropriated. The provision for submarine torpedo boats was struck out of the bill. The New York Navy Yard has been decided upon as the one at which to build the battleship which must be built at a Government yard. Work will be begun at once on the construction of overhead traveling cranes. Specifications will soon be sent out and bids asked on the five ships to be built by contract.

Bids for a Tunnel in Philadelphia.

The Philadelphia Rapid Transit Co., it is said, will soon be ready to advertise for bids for building the Market street subway between Broad street and Twenty-third street.

River and Harbor Improvement.

Brig. Gen. Gillespie, Chief of Engineers U. S. Army, has appointed the board of five officers of the Corps of Engineers to consider all reports upon examinations and surveys provided for by Congress in the river and harbor bill, of which an account was given last week. The Board consists of Col. Alexander Mackenzie, Maj. Harry F. Hodges and Capts. Edward Burr, Charles H. McKinstry and William F. Judson, and it will consider all projects or changes in projects for works of river and harbor improvement heretofore or hereafter provided for. (July 11, p. 556.)

Automatic Whistle Signal to Stop for Train Orders.

The Hocking Valley Railway is trying the apparatus of the Safety Train Order Signal Company, of 66 Broadway, New York City, for warning an engineman, and, if necessary, stopping the engine, on approaching a meeting station. The apparatus has been tested for six weeks

on a passenger engine with satisfactory results. The company is considering the advisability of adopting it. The function of the device is to sound an air-whistle in the cab on approaching a meeting point, or any station where train orders must be asked for; or, in fact, any point which the engineman may wish to provide for in advance; and to open the air-pipe, applying the brakes, in case the engineman shall not heed the warning given by the air whistle. The air valves are opened, at the proper time, by the revolution of a disk, which is turned by gearing that is connected, by a universal joint, with one of the axles of the front truck of the locomotive. By inserting pins at suitable points on the periphery of the disk the engineman can, at the beginning of a trip, provide for the automatic sounding of the warning, and application of brakes, at any or all of the stations on his trip. The revolutions of the disk correspond, of course, to the number of miles traveled by the engine, and the distances are marked on the disk.

New Ships for the Great Lakes.

The American Ship Building Co. has closed contracts with the Great Lakes & St. Lawrence Transportation Co. to build 10 steel steamships to navigate between the upper Lakes and Quebec, in connection with the company's docks and general plant at the latter port. The 10 ships are to be built and ready for operation at the opening of navigation in 1903, and will cost $2,000,000 when completed. The Great Lakes & St. Lawrence Transportation Co. was incorporated last winter in West Virginia with a capital of $2,000,000. By the closing of these contracts the American Ship Building Co., it is said, fills every available berth in all its shipyards on the Lakes and great activity in shipbuilding is thus assured for another year.

The Detroit & Cleveland Navigation Co. has contracted for two more new steamers to ply between Detroit and Cleveland and which will be counterparts of the two boats now operated between Detroit and Buffalo. They will be christened the "North States" and "South States." Each will have a capacity for 3,000 passengers and sleeping accommodations for 700.

The Brooklyn Bridge.

The plans for the improvement of the Manhattan terminal of the Brooklyn Bridge do not seem to progress much. The favorite scheme now is a moving platform, and a company has been organized to install this if permission can be obtained. This company is very strong, including Stuyvesant Fish, E. P. Ripley, Cornelius Vanderbilt, John F. O'Rourke, George W. Young and Moses Taylor Pyne. Mr. George S. Morison has been acting as consulting engineer, and has made preliminary plans. It is proposed that there shall be four speeds, namely, 2½ miles an hour, 5 miles, 7½ miles and 10 miles.

Coke for Locomotive Fuel.

The President of the Boston & Maine Railroad is reported to have said that his company will have 50 locomotives changed to burn coke this summer, and 100 before next January. About a dozen are now running in suburban service. It costs about $50 to change a locomotive, putting in a water grate. By putting racks on the tenders, engines can run 125 to 150 miles without coaling. The cost is just about the same as that of bituminous coal, and it is believed that a saving of $100,000 a year may be made in damages by fires set by locomotive sparks. Mr. Tuttle thinks that coke is just as available in freight service as in passenger service.

Proposals for Washington Aqueduct.

Sealed proposals for 1,168,000 cu. yds. excavation, 122,300 cu. yds. concrete masonry, 2,200 tons cast-iron pipe and specials, 120 sluice gates, 31 water valves, 27 Venturi meters, 141,000 cu. yds. filter sand, 47,600 cu. yds. gravel, 165,000 bbls. American Portland cement, 6 pressure controller valves, 150,000 ft. glazed vitrified pipe (all more or less), and 120,000,000-gallon centrifugal pumping plant will be received at the office of the Washington Aqueduct, until 12 m., August 12, and then publicly opened. Information on application can be had from A. M. Miller, Lieut. Col. Engineers, 2728 Pennsylvania avenue, Washington, D. C.

The "Cyclone" Spike Puller.

A description and illustration of the Pearson "Cyclone" spike puller was given in the *Railroad Gazette*, March 14, 1902. A new pattern has now been put on the market by Charles Morrill, New York. The tool has been considerably lightened. The lifting block has been provided with broad case-hardened rollers, thus doing away with the old frictional contact. Another improvement has been the cutting out of the base, thereby centralizing the strains in extracting a spike.

A 4,000-Ton Freight Train on the N. Y. C.

On Thursday, July 3, one of the new tandem compound locomotives of the New York Central hauled a train of 4,091 tons from De Witt to West Albany, 140 miles, in 11 hrs. 45 mins., consuming about 12 tons of coal. The engine was No. 2,399, class G 2 A, of the same type as the Northern Pacific engine described in the *Railroad Gazette* of Aug. 30, 1901, page 598. The train left De Witt at 9 a.m. and arrived at its destination at 8:45 p.m., making the average rate of speed about 12 miles an hour, which includes the usual stops for water and one stop for coal. The train had helping engines up the grades at the usual places—Canaseraga, Oneida and Schenectady. There were 87 cars and an eight-wheeled caboose. The lading, weighing 2,734 tons, was mostly coal, and the weight of the cars was 1,357 tons; a total of 4,091 tons.

THE SCRAP HEAP.

Notes.

On Thursday, July 3, the number of trains moved to and from the Grand Central Station, New York city, was 585, said to be the largest number ever run on a single day.

A Chicago press despatch says that the Pullman Company has made increases of $10 to $15 a month in the pay of conductors who have served a considerable number of years with the company.

The Canadian Pacific has built at its shops in Montreal a gasoline motor car, weighing about four tons, and with capacity for carrying 14 passengers. It is said that the car will be used as an observation car in the Rocky Mountains.

It is stated that since the Pennsylvania Special, the 20-hour flyer of the Pennsylvania Railroad between New York and Chicago, went into service on June 15 there has been but one occasion when it failed to maintain its schedule. The single failure occurred on July 2, when the eastbound train arrived in New York 2 hours and 15 minutes late.

A considerable number of clerks of the late Plant system are being transferred from Savannah to Wilmington, the headquarters of the Atlantic Coast Line, and it is said that on Aug. 1 about 50 more clerks, mostly employed in the Auditing Department, will go to Wilmington. The Relief and Hospital department of the Plant system is to be continued by the new management.

The heavy rains of last week did great damage to the roadbeds of all the lines in Iowa. The Rock Island's tracks between Neola and Council Bluffs were entirely under water for a day or two, while the tracks of the Milwaukee east of Neola were badly damaged. The bridge on the Chicago Great Western freight line in South Des Moines was almost totally destroyed, the estimated cost of the damage being $30,000.

At St. Louis last Monday the United States Circuit Court of Appeals, in affirming the verdict of a lower court in the case of the Bankers' Casualty Company against the Minneapolis, St. Paul & Sault Ste. Marie, which was in favor of the defendant, declared that a railroad company is merely the agent of the government and is not responsible to a third party for the loss of mail matter. It is responsible to the government only.

On the night of July 8 the Fall River Line steamer "Priscilla" collided with the steamer "Powhatan," of the Merchants' & Miners' Line, near Port Judith, and one of her crew was killed. The bow of the "Priscilla" was stove in so that two compartments were filled with water, and the electric lights were put out. Several hundred barrels of fish had to be thrown overboard. The collision occurred in a dense fog.

On the night of July 13 a train of the Denver & Rio Grande (narrow gage) was stopped by robbers near Chester, Colo., west of Marshall Pass, and two safes in the baggage car were blown open. The contents were taken, but the express company says that no money was lost. After emptying the safes the robbers went back to the passenger cars and got some money and jewelry, but it is said that many of the passengers threw their valuables into the grass.

The *Official Guide* for this month did not appear until July 10, but when it did appear it contained 605 new time-tables, the largest number of new tables ever issued in any one month except on two occasions. Many new trains have been placed in service, and the time of many old trains has been shortened, so that the changes required were very extensive. From 40 to 50 compositors had to work day and night for three weeks to prepare the types for this issue of the magazine.

The St. Louis & San Francisco has announced to its employees the adoption of the "Educational Bulletin System of Discipline." From accounts in local papers it appears that the plan is substantially similar to Brown's, except that there is a provision allowing men to be suspended in case suspension shall be deemed advisable. Sixty demerits will be sufficient ground for dismissal; a clear record for one year will erase 20 demerits, and for two consecutive years will erase all demerits.

The Central of New Jersey has established the office of Time Inspector, and trainmen, station men, etc., have been notified to procure watches of the required standard, if those which they now have do not conform to the requirements. The order names five leading American manufacturers whose watches will be acceptable, and new watches must come from one of these makers. Another road has recently notified its men that stem-setting watches must not be used; those with lever-set being the only kind that will be allowed.

Traffic Notes.

The St. Louis & San Francisco is going to have dining cars on its fast through trains to and from Birmingham.

The Erie Railroad announces that a special cab service has been established between its passengr station at Jersey City and all points in Manhattan and Brooklyn. Low, uniform rates have been established.

Beginning Aug. 2 the Southern Pacific will run large steamships from New York direct to Galveston, carrying through freight to that port instead of New Orleans, as at present. The steamship service to and from New Orleans will be kept up the same as now.

The Alabama Railroad Commission has granted the application of the Alabama Car Service Association to have the demurrage rules of the Commission changed, so that the free time on certain commodities—all those embraced in Rule 1—shall be reduced from 72 hours to 48 hours.

The Louisville & Nashville now runs cars with free reclining chairs on trains 1 and 4 between Cincinnati and New Orleans, and on the corresponding trains between Louisville and Memphis. Each of these cars seats 56 persons and has a large smoking room. There are separate lavatories for men and women, with washstands and towels.

To compete with the excursions from the west to Atlantic City, the Wabash Railroad last week announced excursion rates from Chicago to New York, good for 12 days, at $18 for the round trip, or half price. These rates will be available for four days in July and August. The Pennsylvania at once announced that its Atlantic City excursion rates would be made to include New York, and it is expected that other lines will follow with similar reductions.

The Southern Railway and the Illinois Central have announced to shippers in Louisville that they will pay cartage on certain commodities shipped to competitive points; and there is some talk of a little rate war, as these announcements are evidently made to get traffic away from the Louisville & Nashville, which controls tracks to a large number of manufactories in Louisville.

On the 15th the Louisville & Nashville issued a new tariff, announcing that it would absorb the drayage charges on all freight, inbound and outbound, whether competitive or not.

According to Philadelphia papers, the re-arranged and increased express train service of the Philadelphia & Reading between New York and Philadelphia has produced a marked increase in the traffic, some of the trains carrying many more passengers than were formerly carried on the trains running at about the same time. One conductor says that he carries 35 through passengers where formerly he carried 10. The westbound trains start from New York every hour from 7 a.m. to 6 p.m., and the eastbound trains leave Philadelphia at the same hours. There is also an eastbound train at 7 p.m., and a westbound at 7:30. All of the trains have parlor cars and on 11 of them, each way, there is a buffet. Six westbound trains run through in two hours each. Four of the eastbound make the same time, and two others make nearly the same. Philadelphia papers say that all other trains have to clear the track for these expresses.

Two Hours Made Up By the 20th Century Limited.

On Saturday, July 12, the Twentieth Century Limited of the Lake Shore & Michigan Southern, having been delayed 2 hrs. and 28 mins. near Buffalo, was run from Brocton to Cleveland, 134 miles, in 131 minutes; Cleveland to Toledo 113 miles, 103 minutes; Toledo to Elkhart, 133 miles, in 115 minutes; Elkhart to Chicago, 101 miles, in 111 minutes; and the train reached Chicago only 28 minutes late. The averages shown by the foregoing figures are 481 miles at 62.74 miles an hour; 380 miles at 65.33 miles an hour. Apparently the time consumed in stops at Cleveland, Toledo and Elkhart is not included.

District of Columbia Appropriation Bill.

The appropriation bill for the District of Columbia as finally agreed upon by Congress carries $8,547,526. Among the items included in the bill are $600,000 for the filtration plant, or one-half the amount necessary to finish it, work being now well under way under previous appropriations. The work of reclaiming the Anacostia flats will be commenced on which an ultimate expenditure of $2,000,000 will be necessary. For the proposed new highway bridge across the Potomac River the limit of cost was increased from $568,000 to $996,000 in accordance with the recommendations of the Board of Army Engineers; and the time for its construction is extended two years from Feb. 12, 1903. Bids for this bridge will be asked for without delay and opportunity may be allowed bidders to submit their own plans of construction and architecture. For continuing work on the sewage-disposal system pumping station and for machinery to equip it, $250,000 was allowed and a number of other items of sewer construction and repair were provided for.

Among the bills which failed to pass were bills for new bridges across the Potomac River and across its Eastern branch: for a new union passenger station, and for the memorial bridge.

Irrigation.

Mr. F. H. Newell, Chief Hydrographer of the U. S. Geological Survey, has gone to the Western States to spend the summer in making a thorough preliminary investigation of the irrigation problem. The construction of irrigation works as provided for in the bill passed by Congress last session and previously mentioned in this column, has been placed under the Geological Survey, but it is not expected that actual construction of any of the proposed reservoirs can be begun for a year or two.

A Seven-Masted Schooner.

The first seven-masted schooner ever built was launched at the works of the Fore River Ship & Engine Company, at East Weymouth, Mass., July 10. The ship is of steel and measures 403 ft. over all, 368 ft. on the water line, has a beam of 50 ft. 5 in., and a load draught of 26 ft. 6 in. She has a cargo capacity of about 8,100 tons, and her displacement, when fully loaded, will be about 10,000. Forty-three thousand sq. ft. of canvas will be stretched from seven masts, 155 ft. high. She will carry a crew of 16 men. She will be used in the coal-carrying trade between northern and southern ports.

Burlington Folders.

The Burlington Railroad uses more than two and a quarter million copies of time cards and folders a year. Of this number the lines west of the river use 672,000 copies annually. The approximate cost of paper and printing these folders is $36,000 a year. This is for advertising time cards alone and takes no account of the money spent for pamphlets descriptive of summer and winter resorts. A representative of the passenger department says:

"We use in Omaha about 56,000 folders a month at a cost of about $868. Our Chicago office uses about 75,000, and St. Louis probably 50,000 more. The folders issued by the Omaha passenger department are intended to supply the ticket agents west of the Missouri River—in Nebraska, northern Kansas, South Dakota, Montana, Wyoming, New Mexico, Arizona, Nevada, Utah, Idaho, Washington, Oregon and California. In some respects it is more difficult to keep the Burlington folder up-to-date than that of any other line. The reason of this is that the Burlington time-table shows in condensed form the schedules of almost every western railroad and whenever a change in the time of these latter roads is made it is necessary for the information to be incorporated in our time-tables. Several times we have had to hold our folders four or five days pending the receipt of correct time-tables from the Southern Pacific, Great Northern or Northern Pacific Railroads.

"Different roads have different ideas on the subject of folders. Some roads have as many as 25 different forms. We have tried both plans and are convinced that the

plan of giving complete information about every detail of our service in one folder is more satisfactory to the patrons and better for the road. In California and the Pacific northwest, as well as in Iowa, distributing agencies have been organized. These concerns own folder racks in the principal ticket offices and hotels in the States in which they operate. We send folders to these agencies and they undertake to keep folder boxes supplied with the latest issue. We supply our general agent at San Francisco with 7,000 folders a month. The railroad time-table of to-day is a good deal better than that of five years ago. The arrangement of the pages is better and if a man takes the trouble to study it a minute or two before diving headlong into its contents it is not as mystifying a publication as the humorous papers would have you believe. For a few years the experiment of dispensing with the letters a.m. and p.m. was tried, but it was abandoned and now almost all time-tables use a.m.'s and p.m.'s, as well as light and dark-faced figures.—*State Journal, Lincoln, Neb.*

London's New Tube Railway.

The Great Northern & City Underground Electric Railway which has been constructed on the twin tube principle, but with larger tunnels than in the case of the three similar lines already working, is very near to completion. It takes its title from the fact that it runs into the heart of the City of London from the Great Northern station at Finsbury Park. The diameter of the tunnels is 16 ft., the stations being in some cases 21 ft. and in others 23 ft. The Central London tunnels are only 11 ft. 8½ in. Current will be generated at the power station erected on the banks of Regent's Canal, at 500 volts direct, and it will be distributed on the third rail system at this pressure. The trains are equipped on the B. T. H. master control system with C. E. traction motors, which permits the cars to be run singly or combined in trains of any size, the operation being controlled from any one controller. The British Thomson-Houston Co., of Rugby, have been showing this system of train control in operation at the London tramways and railways exhibition. At the various stations on the Great Northern & City Railway electric lifts will carry passengers to and from the platforms, and there will be ample connections provided between its stations and those of other electric underground systems. The trains will have seven coaches, three being equipped with two motors each. Two points of importance in view of the recent attention which has been devoted to fire prevention on tube railroads, are, the use of concrete platforms instead of wood, and the permanent lighting of tunnels from end to end so that there will be no groping along the tunnels with a torch or tallow candle if mishaps occur to trains part way between stations.

The power station equipment comprises "Economic" boilers by Davey Paxmans, 1,250 h.p. vertical cross-compound engines by Musgraves, of Bolton, driving four 800 k.w. generators. The railroad has been built by Pearsons, the well-known contractors: Sir Douglas Fox and Mr. Francis Fox engineers.

A Railroad in Politics—And Not Ashamed of It.

Birmingham, Ala., July 10.—That the Louisville & Nashville Railroad will make an open fight against the movement to change the present railroad commission system, is boldly admitted by Capt. J. M. Falkner, general attorney for that system in this State. He says that the Louisville & Nashville Railroad is going to fight with all the weapons that are recognized as fair in political warfare. "We come out boldly in the open field, knowing that the issue is with the people of Alabama, and we are not afraid of the people. The men who are behind this movement will exact pledges from candidates for the Legislature, and the Louisville & Nashville people will put some questions to candidates, too." The members of the Alabama Railroad Commission are appointed by the Governor, paid by the railroads and have only advisory powers. The change proposed is that they be elected by the people, paid by the people and be given power to enforce their rulings.—*Atlanta Journal.*

A Himalayan Railroad.

Dr. E. Jung says, in the Journal of the German Railroad Union: From Calcutta, a six hours' journey over the Eastern Bengal Railway brings the passenger to the Ganges. He crosses on a steamboat, on which he takes supper, and on the other side takes a train on the Northern Bengal State Railway, a wretched, narrow-gage road —one of the worst in India. After having been shaken all night in the narrow berths on this railroad, at 8 a. m. the passenger reaches Siliguri, at the foot of the mountains, where begins the famous Himalaya Railroad, of 2 ft. gage, which rises to the dizzy height of 7,603 ft., a height exceeded only on the Callao & Oroya Railroad, in Peru. For a stretch of 50 miles on the crest of the mountains, this road has grades of 238 ft. and even of 370 ft. per mile, and averages 148 ft., and there are curves as short as 687 ft. radius. The train consists of toylike cars, open at the sides, with scant room for eight persons to sit. The speed is so moderate that it takes the train more than eight hours to climb the road up to Dayeeling, 50 miles. The ascent begins in the Terai jungle, famous for its deadly atmosphere, where to spend the night in the hot or the rainy season costs a European his life. The road turns and twists in curves astonishing to an engineer; several times ascending in spirals; it passes along the edge of giddy precipices, and zig-zags when the train is alternately pulled and pushed. After a run of five hours the station of Karseong is reached, where the passengers breakfast. To this point the temperature continues warm, but from there on it cools rapidly. Many passengers remain here a few days to avoid a too sudden change. At 5 in the afternoon the train arrives at Darjeeling. There is only one train daily in each direction. However dense the crowd of natives before a ticket office, as soon as a European approaches it gives way respectfully.

LOCOMOTIVE BUILDING.

The Mobile & Ohio will soon be in the market for 15 locomotives.

The Akron & Barberton is having a locomotive built at the Baldwin Works.

The Des Moines Union is having a locomotive built at the Baldwin Works.

The El Paso & Northeastern is having four locomotives built at the Baldwin Works.

The Alabama Great Southern is having three locomotives built at the Baldwin Works.

The Newburgh, Dutchess & Connecticut has ordered a locomotive from the Baldwin Works.

The Illinois Central is receiving bids for about 38 locomotives: Atlantic type, consolidation and switch.

The Bangor & Aroostook is having three locomotives built at the Manchester Works of the American Locomotive Co.

The Great Northern of Canada has ordered two locomotives from the Pittsburgh Works of the American Locomotive Co.

F. M. Hicks has received orders from the St. Louis & Gulf for four freight engines, which are being rebuilt at the Hicks Locomotive & Car Works.

The Kansas City Belt order for two locomotives with the Baldwin Works, reported in our issue of June 27, calls for simple switch engines; weight on drivers approximately 135,000 lbs.; cylinders, 20 x 26 in.; drivers, 51 in.; straight boiler with working steam pressure of 180 lbs., and 322 tubes; diameter of tubes, 2 in.; length, 10 ft. 5 in.; fire-box, 108⅛ x 42 in.; tank capacity for water, 4,000 gal.; coal capacity, seven tons.

The Chicago, Peoria & St. Louis order for three locomotives, reported in our issue of June 13, calls for simple 10-wheelers, to be built at the Rogers Works; weight on drivers, 110,000 lbs.; total weight, 140,000 lbs.; cylinders, 19 x 26 in.; diameter of drivers, 62 in., with 56-in. centers; extended wagon top boilers, with 256 tubes, and working steam pressure of 180 lbs., tubes to be made of lap-welded C. C. iron; outside diameter, 2 in.; length, 13 ft. 6 in.; carbon steel fire-box, 115 in. long inside, and 33½ in. wide; tank capacity for water, 4,000 gal.; coal capacity, 10 tons. Special equipment includes Westinghouse American air-brakes, hammered iron axles, Corning brake-shoes, M. C. B.-Janney couplers, 18-in. round case Dressel headlights, No. 9 Ohio injectors, Sullivan piston rod and valve rod packings, Crosby 2½ in. safety valve, Leach sanding devices, Michigan No. 3 sight feed lubricators, Scott springs, Ashcroft steam gages, Latrobe driving wheel and truck wheel tires, and cast-iron steel wheel centers.

The Nashville, Chattanooga & St. Louis order, recently reported in our columns, calls for four simple consolidation locomotives, to be built at the Rogers Works for July, 1902, delivery, and for 10 simple consolidations to be built at the Balidwin Works, one to be delivered each month beginning September, 1902. The Baldwin engines will weigh 160,000 lbs.; weight on drivers, 143,000 lbs.; cylinders, 21 x 23 in.; drivers, 55⅝ in.; straight boilers, with 180 lbs. working steam pressure, and 247 charcoal iron tubes, 2¼ in. in diameter outside, and 14 ft. 6 in. long. The fire-box will be 102 x 66 in., of carbon steel; tank capacity for water, 5,000 gal.; coal capacity, 10 tons. The Rogers engines will weigh 134,000 lbs.; weight on drivers, 118,000 lbs.; cylinders, 19 x 26 in.; 50-in. drivers; straight boiler, with 185 lbs. working steam pressure, and 237 charcoal iron tubes, 2¼ in. in diameter by 12 ft. 3 in. long; fire-boxes, 108 x 40 in., to be built of carbon steel; tank capacity for water, 3,000 gal.; coal capacity, seven tons. The special equipment for both classes of engines include Westinghouse-American air-brakes, O. H. forge steel and hammered steel axles, Golmar bell ringers, Kelso tender couplers on pilots, M. M. Buck 22-in. headlights, No. 10 Simplex injectors, United States metallic piston rod and valve rod packings, Coale muffled safety valves, Leach and Economic sanding devices, Nathan sight feed lubricators, French springs, Crosby steam gages and Latrobe and Standard tires. Other specialties include J. W. Thomas, Jr., pneumatic cylinder cock-opener and sectional magnesia lagging.

CAR BUILDING.

The Mobile & Ohio will soon be in the market for 2,500 cars.

The Illinois Central is said to be in the market for cars.

The Minneapolis & St. Louis is reported to be in the market for cars.

The Chicago, Milwaukee & St. Paul is reported as being in the market for 50 cars.

The Mexican National is having 10 cabooses built at the American Car & Foundry Co.

The Atlantic Coast Line is issuing requisitions for building 100 cars per month at its shops.

The Pearl & Leaf River is having three coaches built by the American Car & Foundry Co.

The Missouri, Kansas & Texas has ordered 50 coaches from the American Car & Foundry Co.

The Colorado Fuel & Iron Co. is having two passenger coaches built at the Barney & Smith Works.

The International Construction Co. is having two coaches built by the American Car & Foundry Co.

The American Car & Foundry Co. has orders from different parties for 139 cars of miscellaneous types.

The Terminal Ry. Association of St. Louis has ordered 50 flat cars from the American Car & Foundry Co.

The Gulf & Ship Island, it is said, will build 50 cars at its shops after the completion of the 500 flats reported last week.

The Louisville & Nashville, according to reports, has ordered 500 gondola cars additional to be built at its own shops.

The Shreveport & Red River Valley order for 100 box cars, reported in our last week's issue, are to be 38 ft. long and are for September delivery.

The Hocking Valley has ordered from the Pullman Co. four coaches for the Toledo & Ohio Central. Two more are to be ordered for the same road.

The Nashville, Chattanooga & St. Louis will, it is said, start work at once on 500 box cars which are to be built in the company's shops. These will be of 60,000 lbs. capacity and 36 ft. long inside.

The Mexican Central will place orders in the immediate future for 75 box, 25 coal and 10 water cars. The box will be of 60,000 lbs. capacity; length, over end sills, 36 ft. 6¾ in.; width, over side sills, 9 ft. 1 in.; height, rail to eaves, 12 ft. 6 in., to be built of wood, with wooden underframes. The coal cars will be of 80,000 lbs. capacity; weight of cars, 33,000 lbs.; length over end sills, 34 ft.; width, 8 ft. 10 in.; height, top of floor to top of sides, 51¼ in., to be built of wood with wooden underframes. The tank cars will be of 9,800 gal. capacity; length, over end sills, 36 ft.; length of tank over ends, 33 ft.; smallest outside diameter of tank, 7 ft. 2 in. Special equipment for all three classes of cars includes hammered iron axles, pressed or cast-steel bolsters, National hollow brake-beams, cast-iron brake shoes, Westinghouse brakes, M. C. B. standard brasses, Wagner doors and door fastenings, Soule dust guards, cast-iron journal boxes and malleable iron journal box lids, Sherwin-Williams paint, Mexican Central corrugated iron roof, Scott springs, and Mexican Central trucks of 60,000 and 80,000 lbs. capacity.

BRIDGE BUILDING.

AKRON, OHIO.—The City Engineer has been ordered to get plans as soon as possible for the Mill street viaduct.

ALLEN, N. Y.—According to despatches from the western part of the State, a large number of bridges have been destroyed by recent high waters, 16 of which were in this town.

ASHLAND, KY.—It is said the prospect for building the Ashland-Ironton bridge over the Ohio is bright. The railroads on either side of the river are to take a hand in the construction.

AUGUSTA, GA.—It is possible that the city of Augusta will aid in building a bridge over Little River, in Lincoln County. The county has already appropriated $2,000 toward the cost.

BENWOOD, W. VA.—The city of Bellaire, Ohio, has given a franchise to the Bellaire, Benwood & Wheeling Bridge Co. for the approaches in that city. If all right of way matters are straightened out it is possible that the bridge contract will be let this fall. It will be a cantilever about 2,650 ft. long over the Ohio. Geo. W. Yost, Secretary, Bellaire.

BUFFALO, N. Y.—Bids are wanted July 22 for the substructure and approaches of a bascule bridge on South Michigan street over the city ship canal.

Bids are also wanted at the same time by the Department of Public Works, for building the superstructure of the bridge on South Park avenue over Cazenovia Creek.

Bids are also wanted for building a temporary crossing during the construction of the new bridge on South Michigan street. Francis G. Ward, Commissioner of Public Works.

CALDWELL, IDAHO.—Bids are wanted Sept. 9, according to report, for a bridge over Fayette River, to be 352 ft. long. J. N. Bernard, Chairman, County Commissioners.

CHILLICOTHE, OHIO.—Separate bids are wanted July 21 on the substructure and superstructure of a bridge over Walnut Creek. Harry S. Adams, County Auditor.

CINCINNATI, OHIO.—The scheme to build a viaduct from East Fourth street to Mount Adams is again under consideration by the Board of Public Service. According to the latest ordinance introduced, the bridge is to be a Y, costing about $1,000,000.

CLEVELAND, OHIO.—Wm. J. Carter, City Engineer, tells us that it is proposed to build a bascule bridge over Cuyahoga River at Jefferson street. The bridge will be about 140 ft. long and cost $180,000. There is nothing decided.

COLUMBUS, OHIO.—The Columbus, London & Springfield R. R. has agreed to pay 35 per cent. of the cost of building three culverts on Summit street, near Indianola.

Plans are being made by County Surveyor Henry Maetzel for the two bridges to cross the railroad tracks on Cleveland avenue. The contracts will probably be let next month.

DONALDSONVILLE, LA.—See Louisiana Roads under Railroad Construction.

EGANVILLE, ONT.—The County Council have had revised plans prepared and is inviting tenders for a bridge over the Bonnechere River at this place. Estimated cost, $15,000.

EUGENE, IND.—A vote is to be taken in Eugene Township to consider building a bridge over the Wabash River east of that place. Estimated cost, $12,000.

GREEN BAY, WIS.—The building committee on the Suamico bridge has rejected all bids and will want new bids in the near future.

HAGERSTOWN, MD.—The Cumberland Valley R. R. will build a stone arch bridge at Falling Water, to replace the present trestle over the Potomac.

HARRISBURG, ILL.—Bids are wanted July 20 by Albert Lewis for a steel bridge at this place.

HARRISBURG, PA.—Engineers have been appointed by the Board of Public Buildings and Grounds, of which Governor Stone is president, to prepare plans and specifications for the erection by the State of a large number of bridges under the act of 1895, which provides for the rebuilding of county bridges burned or carried away by flood. The engineers are Andrew J. Whitney, Rome, Bradford County; Mark D. Bowman, Mahanoy City; Herman Laub, Pittsburgh; Oscar E. Thomson, Phœnixville; Emil Swensson, Pittsburgh. The bridges to be replaced will be in Juniata, Berks, Carbon, Forest, Bradford, Clearfield, Jefferson, Lycoming, Lackawanna, Wyoming, Sullivan, Wayne and Luzerne Counties. Their total cost is estimated at $500,000.

City Engineer Weirman has called the attention of City Councils to the dangerous condition of Mulberry street overhead bridge. About $6,500 worth of repairs are needed.

It is said plans are soon to be made for the new bridge for the Harrisburg Bridge Co., to replace the old "camel-back" bridge recently destroyed.

KNOXVILLE, TENN.—See Other Structures.

KNOXVILLE, TENN.—The County Court of Granger County has decided to build a bridge over Holston River.

LEWISBURG, PA.—Bids are wanted until July 21, at the office of the Town Clerk, for building a steel girder bridge over Limestone Run.

LIBERTY, MO.—Bids are wanted Aug. 6 by Edgar Main for building six steel bridges.

LOS ANGELES, CAL.—The Beach Land Co., Henry P. Barbour, President, according to report, will build a large stone arch bridge.

MAUSTON, WIS.—Bids are wanted by the Common Council until Aug. 1, for a single span steel bridge across the Lemonweir River on Union street, to be 140 ft. long, 16 ft. roadway and 6 ft. sidewalk.

MILWAUKEE, WIS.—Bids are wanted Sept. 5 by the Commissioners of Public Works, for building the highway bridge across North Menomonee Canal at Muskego avenue.

MINNEAPOLIS, MINN.—The County Auditor will soon want bids for a steel girder bridge over Cedar avenue at the crossing of Mother Lake.

MONACA, PA.—A company has been formed by John T. Reeves, F. E. Brierly and F. G. Barker, to build a bridge over the Ohio between Monaca and Freedom.

MONTGOMERY, PA.—The County Commissioners have decided to build a bridge over Pine Creek at Slate Run.

MONTICELLO, ILL.—Contracts for two bridges will be let on July 22. Address Ira O. Baker, Champaign, Ill.

NEW CASTLE, PA.—The West Pittsburgh Connecting R. R., recently incorporated, will build a bridge over Beaver River, with a main span of 900 ft. Henry O. Evans, of Pittsburgh, is interested.

NEWPORT, IND.—Bids are wanted by Wm. P. Bell, County Auditor, until Aug. 5, for some bridge work.

NIAGARA FALLS, ONT.—See Welland, Ont.

OBERLIN, KANS.—Bids are wanted Aug. 14 by J. E. Platts, County Clerk, for a steel bridge.

OSHKOSH, WIS.—It is said plans and specifications have been made for a new double-track steel bridge over Fox River for the Wisconsin Central.

OWEN SOUND, ONT.—The County Council has appointed a committee consisting of Messrs. Gordon, Har-

ness, Preston, McLean and others to select sites for building of bridges on the town lines.

PITTSBURGH, PA.—The Borough Council of East Pittsburgh passed an ordinance for a viaduct from Cable avenue to Oak Hill, nearly one-quarter mile long.

RICHMOND, QUE.—We are told that the contract for building the two-span steel bridge over St. Francis River at Richmond has been let to the Dominion Bridge Co., of Montreal. The structure will be 750 ft. long, and cost $51,000.

ROME, N. Y.—Contract for building the bridge over the Mohawk at East Dominick street has been let to the Owego Bridge Co. at $14,500. The other bidders were the United Construction Co., of Albany, and the Canton Bridge Co., of Canton, Ohio.

RUTLEDGE, TENN.—The County Court has appointed a committee to contract for a steel bridge to be built four miles below this town.

ST. CATHARINES, ONT.—Johnson Clench, county clerk, is receiving tenders for an arch culvert on Queenston and Grimsby road.

ST. LOUIS, MO.—According to despatches from St. Louis, there is some probability of the early building of the proposed third bridge over the Mississippi between St. Louis and East St. Louis. We recently reported that the Third Bridge Co. was pushing matters with the expectation of having the work finished within a year or so. It is now said that a company has been formed with the following as incorporators: D. C. Vanblarcom, Vice-President of the National Bank of Commerce, St. Louis; Edward F. Goltra, President, American Steel Foundry Co.; W. B. Doddridge, formerly chairman of the Executive Committee of the Terminal Association; Mayor M. M. Stevens, of East Louis, and T. C. Doremus, of New York City. The company also proposes to build large terminals and an elevated road, the cost of which, not including the bridge, will reach about $10,000,000.

There will be one 150-ft. span bridge on the Carthage & Western line of the Missouri Pacific, where it crosses the north fork of Spring River; also one 50-ft. span across Mulberry Creek. A contract for trestles has been let to McNerney & Co. (See Railroad Construction column.)

Bids are wanted July 29 for a steel railroad bridge at Bissel's Point, and for other work. Address Hiram Phillips.

SAGINAW, MICH.—There is talk of readvertising for bids on the Genesee avenue bridge, the contract for which was recently let to the National Bridge Co.

SAN ANTONIO, TEXAS.—Bridges proposed at this place are: Across San Antonio River at Navarro street; across San Antonio River at Neuva street, and also a bridge over the same river connecting St. Mary's and Soledad.

SAN FRANCISCO, CAL.—The Mayor has approved the resolution granting permission to the Atchison, Topeka & Santa Fe to build a steel drawbridge across Channel street at the foot of Third street.

SIOUX CITY, IOWA.—The city is considering building an 800-ft. viaduct on Wall street, from Fourth to Grand streets, at a cost of about $100,000.

SOUTH BEND, IND.—There is talk of building a bridge over the St. Joseph River at Washington or Jefferson streets, or at Colfax avenue, but there are no immediate prospects of getting bids. The contract for building the 770-ft. span Melan arch over the East Race on East Colfax avenue, has been let to Fred. Hoffman at $8,495. The contract for building the bridge over Wenger Creek, on Pennsylvania avenue, is also let to Mr. Hoffamn.

The contracts for the smaller bridges, arch culverts and I-beam culverts along the line of the Indiana Ry., also for a three truss steel 300-ft. span to join the highway bridge over the St. Joseph River, in South Bend, have been awarded to the Canton Bridge Co. No contracts have been made for the other bridges. Alonzo J. Hammond, Engineer.

SPOKANE, WASH.—The Northern Pacific has had plans made for the new steel viaduct over Washington street. Plans are also being made for the subway and steel overhead bridge at the Sprague avenue and Division street crossing.

TIPTON, IND.—Bids are wanted July 26 for 10 small steel bridges. Address E. Perry, County Auditor.

TRENTON, N. J.—See Other Structures.

TROY, OHIO.—It is said a new steel bridge will be built soon to replace that structure which formerly crossed Lost Creek on the Dayton and Troy Pike.

TUPPERVILLE, ONT.—Bids are wanted July 26 for building a steel drawbridge over Sydenham River at this village. Address Archie McArthur, Municipal Clerk, Tupperville.

WADENA, MINN.—A bridge about 160 ft. long is proposed over Crow Wing River, in Lyons Township, and we are told that the contract will be let on or before Nov. 1, but in the meantime John Alson will be glad to hear from bridge builders in regard to same.

WELLAND, ONT.—It is said that the Department of Railways and Canals is preparing plans and specifications for removing obstructions in the Welland Canal between Port Colborne and Welland. These obstructions consist of stone piers or bridges, removal of which will require the rebuilding of the bridges. The amount voted by Parliament for this work is $95,000, and bids are to be called for as soon as the plans are finished.

The Montrose bridge over the Chippewa River near Niagara Falls, Ont., is to be rebuilt by the municipality at a cost of about $9,000. R. Cooper, of Welland, is the County Clerk.

YOUNGSTOWN, OHIO.—Local reports state that something has soon to be done in regard to a temporary bridge over Mill Creek on the Mahoning avenue extension.

ZANESVILLE, OHIO.—Reports from this place say that some 50 bridges were destroyed by the recent heavy rainstorm.

Other Structures.

ALLEGHENY, PA.—The Pressed Steel Car Co. has bought a tract of land adjoining its Allegheny plant, which it proposes to use as a steel yard. It is probable that in the near future a part will be used for an extension of the power plant, although this is not yet determined upon.

ALTOONA, PA.—The Pennsylvania R. R. proposes to build a plant at Altoona for repairing steel cars. Contract is said to be now under consideration and will probably be let in a few days. The building will be a steel structure 70 x 300 ft. The total cost of the work will be about $200,000.

ATLANTA, GA.—In regard to the report that the Southern Ry. contemplates building new passenger stations at East Rome and at Atlanta, we are told that there is no truth in it.

BALTIMORE, MD.—The plans for the first of the new piers to be built by the Baltimore & Ohio at Locust Point have been completed and work is to be begun at once. It is said that the cost will be $600,000. The pier will be 800 ft. long, 48 ft. wide and 50 ft. high.

CANTON, OHIO.—Definite steps have been taken by the United Steel Co., of Canton, for building the new plant to supply independent sheet steel manufacturers with billets, etc. The plans were made by Victor Buettner, of Pittsburgh. The main building will contain two open-hearth furnaces of 35 tons capacity to a heat. It will be 100 ft. wide and 500 ft. long. The cost of the first building, contracts for which have been let to the Fort Pitt Bridge Co., will be $30,000.

CHESTER, PA.—The Pennsylvania R. R. has decided to build a new passenger station at Chester, on the south side of the tracks.

CHEYENNE, WYO.—General Manager Dickinson, of the Union Pacific, is reported as saying that the shops in Cheyenne were closed owing to the strike conditions, the same as the Omaha and Armstrong shops were closed, and the company does not propose to abandon them but has decided to inaugurate piece work over the entire system. Mr. Dickinson and Superintendent McKeen are inspecting the various shops.

COATESVILLE, PA.—The Lukens Iron & Steel Co. has bought some land a short distance west of this place, where several blast furnaces will be built.

CRESTON, IOWA.—It is said the Burlington contemplates building a much larger roundhouse in Preston in the near future.

DENVER, COLO.—An officer of the Chicago, Rock Island & Pacific tells us that there is no truth in the report that that company will establish shops in Denver.

EDGEMOOR, DEL.—The Pennsylvania R. R. has let the contract for the foundation work on its new car shop buildings at Edgemoor. This is the beginning of the moving of the car shops from Wilmington.

ELLWOOD CITY, PA.—The Union Chain & Forge Co. has been formed with $100,000 capital, to build a plant at Ellwood City. The incorporators are C. M. Goodfellow, Arthur Kugemann, Robert A. Todd and others.

EL PASO, TEXAS.—The Galveston, Harrisburg & San Antonio (Southern Pacific) has begun preliminary arrangements to build a new shop in this city. The building will be 120 x 160 ft., and be built of brick. Contracts have not been let.

EVERSON, PA.—Plans are being made by the Edgar S. Low Co., of Pittsburgh, for building a large car works in Everson, at which wooden cars will mainly be built. The plant will consist of three main buildings, one of which will be 100 x 60 ft., the other two being smaller.

FORT SCOTT, KAN.—The St. Louis & San Francisco proposes to enlarge the car shops and build a $30,000 roundhouse at this place. The yards will also be enlarged, making the total outlay about $100,000.

HOXIE, ARK.—The new Iron Mountain shops, roundhouse, office buildings and yards at Hoxie, now building, will probably be ready within 90 days. The site is 350 ft. wide and two miles long. About $100,000 will be spent.

KNOXVILLE, TENN.—Contract for the terminals of the Knoxville, LaFollette & Jellico R. R. will probably be let soon. The company will also build a bridge over Clinch River about two miles below the one now used by the Southern Ry.

NEWARK, N. J.—The general contract for building the new Broad street station for the Lackawanna R. R. has been awarded to F. D. Hyde, of New York. The building is to be of brick and two stories high. It will be 180 ft. long and 80 ft. wide, and will have an extension shelter shed 130 ft. long by 30 ft. wide. The station is located between High and Broad streets. The same contractor has been awarded contracts for three one-story freight houses to be built at Summit, Dover and Morristown, at a cost of $10,000.

NEW BRUNSWICK, N. J.—At the first meeting of the stockholders of the Raritan Structural Steel Co., recently organized, the following directors were elected: Charles F. Terney, Winfield S. Thorp, Julian M. Pinkney and John A. Gerken, New York, and George A. Viehmann, New Brunswick. The directors elected these officers: President, Charles F. Terney; Vice-President, John M. Gerken; Secretary, Winfield S. Thorp; Treasurer, Julian M. Pinkney. The company has 12 acres of ground along the Pennsylvania Railroad, near Millstone Junction, and will build a large plant there. It is expected that the work will be commenced in August.

NEW YORK, N. Y.—The Department of Docks and Ferries is about to rebuild piers Nos. 12, 13 and 14, now occupied by the Central R. R. of New Jersey, and will replace them with two piers of modern type and of steel construction, at a cost of about $300,000.

PERTH, ONT.—The Canadian Pacific shops at this place were destroyed by fire a week ago and steps have already been taken to rebuild at once. The new buildings, it is said, will be much larger than the old structures.

PITTSBURGH, PA.—The Garland Nut & Rivet Co. is being formed to build a plant in West Pittsburgh. Most of the stock of this company is owned by the stockholders in the Garland Chain Works at Rankin, and the rivet department, now conducted in connection with it, will be removed to the new plant.

ST. LOUIS, MO.—The Chicago, Rock Island & Pacific, in addition to its provision for terminal yards in the West End, is negotiating for property down town on which to build a large freight station.

SCRANTON, PA.—The D., L. & W. will build a freight station on Mattes street.

SPRINGFIELD, MASS.—The Springfield Street Ry. has plans nearly perfected for practically doubling the capacity of its power plant.

TOLEDO, OHIO.—The Donovan Wire & Iron Works will build a $30,000 plant in this city.

TRENTON, N. J.—Official announcement is made that the Jordan L. Mott Iron Company's plant will be moved from Mott Haven, N. Y., to Trenton. The first structure to be erected will be a power house on which, it is said, work will be begun Aug. 1. The other buildings will be constructed as rapidly as circumstances will allow. One of these will be the foundry, which will be about 500 ft. long and one story high. There will also be an enameling shop about 300 ft. long. The machine shop and the brass shop will each be of good proportions and four stories in height. There will be two other buildings, which will be smaller in size. The power house will have a chimney 175 ft. high. A bridge will be built across the canal connecting the new plant with the Trenton Fire Clay & Porcelain Works.

VANCOUVER, WASH.—The Washington & Oregon R. R. has let contracts for the stations at Woodland and Ridgefield. They are not very costly structures, but a large station will be built at Vancouver as soon as the bridge across the Columbia is well under way.

WASHINGTON, D. C.—Out of the appropriation made by Congress for new Army Barracks, as noted last week, the Secretary of War has apportioned $650,250, as follows: Vancouver Barracks, Wash., buildings and accommodations for one regiment of infantry and two batteries of field artillery, $142,000; Fort Lawton, Wash., for one battalion of infantry, $105,500; Fort Wright, Wash., $27,000; Madison Barracks and Fort Ontario, N. Y., $180,750; San Francisco, Cal., for a depot for recruit instruction, most of the work to be done by the troops, $75,000; Whipple Barracks, Ariz., work of rehabilitating the post, $120,000.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xviii.)

Iron and Steel Institute (British).

In accordance with previous announcements the autumn meeting of the Iron and Steel Institute will be held at Düsseldorf, on Wednesday and Thursday, Sept. 3 and 4, 1902. Mr. E. Schroedter, General Secretary of the Society of German Ironmasters, will act as honorary local secretary, and an influential reception committee has been formed. The Directors of the Norddeutscher Lloyd have offered to the members attending the meeting complimentary first-class passages, including table, to the number of 250, by the steamship "Kronprinz Wilhelm" (15,000 tons, 35,000 i.h.p.), upon that ship's homeward voyage to Bremen, on September 1, from Plymouth.

The provisional programme of the meeting is as follows:

On Tuesday, September 2, the members will arrive at Düsseldorf.

On Wednesday, September 3, the President, Council and members, will be received by the civic authorities in the Municipal Concert Hall. A selection of papers will subsequently be read and discussed. In the afternoon a visit will be paid to the Düsseldorf Exhibition. In the evening, the members and the ladies accompanying them, will be invited by the Mayor and Corporation of Düsseldorf to a Conversazione and Concert.

On Thursday, September 4, the morning will be devoted to the reading and discussion of papers, and the afternoon to visits to the exhibition and to works in the immediate vicinity. In the evening, the members of the Institute and ladies accompanying them, will entertain the Reception Committee and the Ladies' Committee at a banquet.

On Friday, September 5, the whole day will be devoted to visits to works. Five groups will probably be formed, proceeding respectively to Essen (the Krupp Establishment), Dortmund (the "Union" Company, the Hoerde Works, the Hösch Steelworks), Ruhrort (the Phœnix Works, the "Rheinische Stahlwerke"), Oberhausen (the Gutehoffnungshütte), Duisburg (the Vulcan Works, the Duisburger Maschinenbau Actien-Gesellschaft, formerly Bechem and Kretman). In the evening the Exhibition grounds will be specially illuminated in honor of the Institute.

On Saturday, September 6, there will be an excursion for members and ladies to the picturesque district of Vohwinkel, to the Elberfeld suspended railroad, and to the Kaiserbridge, near Müngsten. The party will return to Düsseldorf by 4 p.m.

In addition to the visits and excursions mentioned, a limited number of members will leave Düsseldorf on Friday evening to visit the Peine and Ilsede works, and a similar party to visit works in the Saar district.

Pacific Northwest Society of Engineers.

The Pacific Northwest Society of Engineers held its regular monthly meeting at the Chamber of Commerce rooms in Seattle, Saturday evening, July 5. The meeting was presided over by Mr. R. H. Thomson, President, and a paper entitled, "Comparative Tests of Yellow Pine and Puget Sound Fir," was read by Mr. Frank W. Hibbs, Naval Constructor, U. S. Navy. Mr. Hibbs had a very exhaustive paper on this subject, having recently, by direction of the Navy Department, made numerous tests both on yellow pine and Puget Sound fir with reference to their relative value for use on ship work. These tests comprise transverse tests, column tests, tensile tests, both longitudinally and transversely, end and side grained compression tests, shear tests, and torsion tests. The form of the test specimens was, in many instances, new and will undoubtedly prove of value in making future tests. The most striking features exhibited were the differences between yellow pine and fir as regards their texture, the yellow pine showing up more brittle and better able to stand wear, owing to the great amount of pitch contained; while the fir showed up more fibrous and better calculated for use in beams and tension members. The most striking single test was the one made for torsion, in which the yellow pine simply cracked and pulled apart; while the fir twisted almost like rope, the fibers standing out in distinct strings. The tests were made on green lumber, air seasoned and kiln-dried, as well as on specimens which had been fire-proofed, so that the series comprises the most valuable that has ever been made on Puget Sound timber.

The paper proved to be of great interest to the members present and was much discussed. It is proposed to devote another meeting to discussion after the paper has been printed and been more carefully studied by those desiring to take it up in detail.

The meeting adjourned to meet the first Saturday in August, when a paper, "Septic Tank Sewerage Systems," will be presented by Mr. R. H. Thomson, City Engineer, of Seattle, Wash.

PERSONAL.

—Mr. W. A. Winburn, Traffic Manager of the Central of Georgia, has been elected Vice-President of the company.

—Lieut. Col. William R. Livermore, Corps of Engineers U. S. Army, who has recently returned from duty as military attache of the United States embassy at Copenhagen, Denmark, has been ordered to duty at New York as a member of the Board of Engineers.

—Mr. Charles C. Gilman, a well-known railroad contractor of Marshalltown, Iowa, died at Chicago, Ill., July 10. Mr. Gilman was born at Chelsea, Mass., in 1848, and his railroad service dates from 1868, when he entered the employ of the Iowa River as an Assistant Engineer. From 1871 to 1877 he was Chief Engineer of the Central Railroad of Iowa and later of the old Wisconsin, Iowa & Nebraska, now the Chicago Great Western. At the time of his death Mr. Gilman was doing extensive work for the Baltimore & Ohio.

—The new Master Mechanic of the Albany Division of the Boston & Albany, Mr. W. B. Leach, is 32 years old. After serving his apprenticeship he went, in the summer of 1890, to the Boston & Albany as a machinist at the Boston shops. The next year he went to the Roxbury

shops of the Providence Division of the Old Colony Railroad, and in 1893 was appointed wrecking foreman of the same division. The following year he was appointed erecting shop foreman and held both positions until 1896, when he resigned to take the position of General Foreman of the New England (New York, New Haven & Hartford) and continued with this company until his new appointment on the Boston & Albany.

—Mr. Frank W. Buskirk, Assistant General Passenger Agent of the Erie, with headquarters in Chicago, has resigned, to take effect on the first of August. Mr. Buskirk leaves railroad service to devote his time to private interests. He has been with the railroads for 35 years, having taken service with the Winona & St. Peter as a clerk when he was 19 years old, after having served in the Civil War. From 1880 to 1884 he was ticket agent of the Cleveland, Columbus, Cincinnati & Indianapolis at Cincinnati, Ohio, leaving that company to accept the position of Passenger Agent of the Pennsylvania Lines at Cincinnati. In 1892 he was appointed Assistant General Passenger Agent of the Erie, in charge of Western Lines. Recently his jurisdiction was extended so as to be co-extensive with that of the General Passenger Agent.

—Mr. C. M. Hunt, General Superintendent of the St. Louis, Memphis & Southwestern, is a native of Ohio, having been born at Athens in 1860. He entered railroad service at the age of 16 years, with the Lafayette, Muncie & Bloomington. In 1880 Mr. Hunt went west and was appointed train despatcher of the Denver & Rio Grande, but returned east the following year, and from then until 1888, was despatcher on various roads. In the fall of 1888, he was appointed chief despatcher for the Missouri Pacific. In 1893 he became trainmaster for the St. Louis, Iron Mountain & Southern. In 1899 he went with the Ft. Worth & Denver as Assistant Superintendent, and in March, this year, Mr. Hunt became Superintendent of the Memphis Division of the St. Louis, Memphis & Southwestern and assumed the General Superintendency on July 1, last.

—Mr. John N. Faithorn, who has just become Vice-President of the Chicago & Alton, was born in London, England, in 1852, and entered the railroad service as a clerk on the Alton in June, 1875. In 1885 he became Auditor of the Southwestern Railway Association, and in April, 1887, Commissioner of the Western Freight and Northwestern Freight Associations. Subsequently he held the following positions: Commissioner of the Western and Northwestern Freight Bureau, Chairman of the Western Freight Association, Chairman of the Southwestern Railway & Steamship Association, Commissioner of the Western Freight Association, Vice-President and General Manager for Street's Western Stable Car Company, General Manager Wisconsin & Michigan, and President and General Manager of the Peoria & Northern. In 1899 he was made President and General Manager of the Chicago Terminal Transfer Railroad.

—Mr. Alonzo Tripp, whose appointment as Assistant Superintendent of the Charleston Division of the Southern Railway was recently noted in the *Railroad Gazette*, was born Sept. 24, 1839, at Kennebunk, Me. He began his railroad service in 1867 as an Agent for the Allegheny Valley at West Pennsylvania Junction, since which time he has been consecutively from 1867 to 1883 freight and ticket agent and yard master. From 1883 to 1890 he was general yard master of the Baltimore & Ohio. Then for three years he was Superintendent of the Charleston, Cincinnati & Chicago and for five years following held a similar position with the Ohio River & Charleston, successor to the Charleston, Cincinnati & Chicago. From 1898 to 1899 Mr. Tripp held the Superintendency of the North Carolina Division of the South Carolina & Georgia, and was Superintendent in charge of operation on the South Carolina & Georgia Extension Railroad from 1899 until his recent appointment as above.

—Mr. R. R. Hammond, who on August 1 next will assume the duties of Assistant General Manager of the Missouri, Kansas & Texas, was born at Ottumwa, Iowa, in 1857. He received his education in the public schools at that point and later attended Baker University of Kansas, and Iowa Wesleyan University of Mount Pleasant, Iowa. Mr. Hammond entered railroad service in 1876 as an agent and operator on the Chicago, Burlington & Quincy, and was at various points on their Middle Iowa Division, where he remained until 1881, when he went with the Kansas City, Fort Scott & Memphis as an operator. He was then transferred to Springfield as train despatcher, being promoted to chief despatcher in 1882, and trainmaster in 1888. In 1895 he became Division Superintendent in charge of the line between Springfield and Memphis. Three years later he was made General Superintendent of the Kansas City, Fort Scott & Memphis and the Kansas City, Memphis & Birmingham, which position he retained until August, 1901, when owing to the sale of the above roads to the St. Louis & San Francisco he was made Superintendent of Maintenance of the 'Frisco System at Springfield, Mo.

ELECTIONS AND APPOINTMENTS.

Arkansas & Choctaw.—On July 10, J. Campbell was elected President, succeeding J. Scullin, resigned.

Brunswick & Birmingham.—L. T. Westrich has been appointed General Superintendent.

Canada Atlantic.—J. W. Smith has been appointed Purchasing Agent, with headquarters at Ottawa, Ont.

Charleston & Western Carolina.—E. Williams has been appointed General Freight and Passenger Agent, with headquarters at Augusta, Ga., succeeding W. J. Craig, promoted.

Chicago & Alton.—John N. Faithorn has been appointed Vice-President in charge of traffic, with headquarters at Chicago, Ill.; effective July 10.

Chicago, Rock Island & Pacific.—Owing to the redivision of the territory of this company's Lines West of the Missouri River the following Master Mechanics have been appointed: A. L. Studer, heretofore Assistant Superintendent of Motive Power and Equipment, has been appointed Master Mechanic of the Kansas Division, with headquarters at Horton; E. O. Cole becomes Master Mechanic of the Nebraska Division, with headquarters at Fairbury, Neb.; W. E. Anderson, Master Mechanic of the Colorado Division at Goodland, Kan.; A. C. Adams, Master Mechanic of the Oklahoma Division at Chickasha, and D. D. Robertson, Master Mechanic of the El Paso Division at Herrington. The positions of Assistant Superintendent of Motive Power and Equipment, General Foreman at Goodland and at Herington, formerly held by Messrs. Studer, Anderson and Robertson, respectively, have been abolished.

Choctaw, Oklahoma & Gulf.—The position of General Manager, held by H. G. Clarke, has been abolished, and W. W. Wentz, Jr., heretofore General Superintendent of the Central of New Jersey, has been appointed General Superintendent of the C., O. & G.

Cincinnati & Muskingum Valley.—William Meikle, heretofore General Foreman of Shops and Road Foreman of Engines, has been appointed Master Mechanic. T. Dreyfus succeeds Mr. Meikle.

Denver, Northwestern & Pacific.—A. C. Ridgeway, General Manager of the Colorado Springs & Cripple Creek, has been appointed General Manager of the projected Denver, Northwestern & Pacific.

Denver & Rio Grande.—W. B. Glardon has been appointed Superintendent of Telegraph, with headquarters at Denver, Colo.

Detroit Southern.—J. W. Sherwood, General Superintendent, with headquarters at Detroit, Mich., has resigned.

East & West.—Charles R. Capps has been appointed General Freight Agent and C. B. Ryan, General Passenger Agent, succeeding Bart Cowden, transferred.

Erie.—D. M. Bowman has been appointed Assistant General Passenger Agent, with headquarters at Chicago, Ill., succeeding F. W. Buskirk, resigned.

Fremont, Elkhorn & Missouri Valley.—P. Hays has been appointed Assistant Division Superintendent.

Long Island.—J. Stanley Brown, heretofore Assistant Secretary of the Union Pacific, has been appointed Assistant to the President of the L. I.

Mobile & Ohio.—We are informed that the reports that J. N. Seale, Superintendent of Transportation, had resigned, and that H. Clarke had been appointed to succeed Mr. Seale, are entirely without foundation.

New England Car Service Association.—S. Anderson, heretofore Assistant Division Superintendent at Taunton, Mass., of the New York, New Haven & Hartford, has been appointed Manager of the N. E. C. S. A., with headquarters at 17 Milk street, Boston, Mass., succeeding C. L. Mayne. The territory of this Association comprises the stations in the States of Massachusetts, Connecticut, Rhode Island and New Hampshire on the following lines, viz.: Boston & Albany, Boston & Maine, Grand Trunk, Maine Central, New York, New Haven & Hartford; Central New England and Union Freight, and on the Central Vermont in Connecticut; Bellows Falls stations, Vt.; stations on New York and Highland Divisions of the New York, New Haven & Hartford in the State of New York, excepting Harlem River, Fishkill Landing and Hopewell.

New York Central & Hudson River.—F. Wiegand has been appointed Supervisor of Signals, on the River Division, with headquarters at Weehawken, succeeding S. Guthorn; effective July 15.

Pullman Company.—Edward R. Slagle, heretofore Acting Manager, has been appointed Manager.

Richmond, Fredericksburg & Potomac.—J. P. Nelson has been appointed Chief Engineer, with headquarters at Richmond, Va. C. W. Culp, heretofore Passenger Trainmaster of the Pennsylvania, has been appointed Assistant General Manager of the R., F. & P., with headquarters at Richmond, Va.

Texas Central.—The headquarters of R. M. Cox, Superintendent, have been removed from Walnut Springs, Texas, to Waco, Texas.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA & MISSISSIPPI.—According to most recent reports, grading is completed on this new line from Vinegar Bend, Washington County, Ala., to Leakesville in Green County, Mo., 14 miles southwest, and track has been laid for a majority of the distance. Surveys are also being made beyond Leakesville, with the ultimate intention of building to Ellisville, Miss., 200 miles from Vinegar Bend. The company was incorporated last February by R. Turner, H. C. Turner and others, of Vinegar Bend, Ala.

ALBERT SOUTHERN.—According to press reports, G. D. Prescott, of Albert, Ontario, and the Messrs. Alcrofts, of London, Eng., are negotiating for the purchase of this line. It was incorporated in 1884, and earned a subsidy of $50,460 by building from a junction with the Salisbury & Harvey Ry. at Albert, to Aylmer, 17 miles. It has not been in operation for the last year or so.

ARKANSAS & LOUISIANA.—An amendment has been made to this company's charter providing for an extension 25 miles long from the present terminus at Hope, Ark., to Stamps. The Arkansas & Louisiana is a proprietary company of the Missouri Pacific, and runs from Nashville, Ark., to Hope, 25 miles, making connection at Hope with the St. Louis, Iron Mountain & Southern. Russell Harding is General Manager.

ATCHISON, TOPEKA & SANTA FE.—An officer writes that the current reports that work is soon to begin on the line from Portales to Albuquerque, N. Mex., is incorrect and that the company has no definite plans in the matter.

BOONE MOUNTAIN.—Charter was granted this company in Pennsylvania July 10, to build a railroad from a point near Weedville, on the Allegheny Valley, to a point on the Erie, at or near Helen Mills in Elk County, Pa., a distance of 13 miles. H. H. North, of Bradford, Pa., is President.

CANANEA, YAQUI RIVER & PACIFIC.—This company has been organized in Arizona, with the stated purpose of building about 600 miles of railroad in Mexico. Wm. C. Green and Norton Chase, of New York, are interested.

CARTHAGE & WESTERN (MISSOURI PACIFIC).—An officer writes that the route of this line, chartered in the interest of the Missouri Pacific June 19, will be from a point about 1½ miles north of Carthage, Mo., running northwest to Alba, Neck City and Georgia City to Asbury, on the Kansas City & Southern, a distance of about 18 miles. Surveys are completed and work will begin in a few days. Contracts for grading and bridging, as far as trestles are concerned, have been awarded to McNerney & Co. The work is generally light, with maximum curvature of 3 deg., and maximum grade of .75 of 1 per cent. There will be one 150 ft. span to cross the north fork of Spring River, and one 50 ft. span across Mulberry Creek. H. Rohwer, St. Louis, is Chief Engineer. (July 4, p. 543.)

CENTRAL NEW ENGLAND.—Track laying on the extension from Tariffville, Conn., to Springfield, Mass., which has been a source of so much litigation, was reported completed July 9, and it is expected that as soon as two girder bridges on the line are completed, which will probably require a month more, coal trains will be run over the entire line from Pennsylvania, by way of the Poughkeepsie bridge, into New England. (June 13, p. 453.)

CENTRAL ONTARIO.—This road, which extends from Picton to Bancroft, Ont., 116 miles, has been ordered sold under a mortgage of $2,200,000 held by the Toronto General Trust Corporation, trustee. The loan and mortgage was made 20 years ago, since when no interest has been paid. The identity of the bondholders has been referred to a chancery court.

CENTRAL RAILWAY (NOVA SCOTIA).—Announcement is made that this line, which is in operation from Middleton Junction, N. S., to Lunenburg, 74 miles, has been taken over by Mackenzie & Mann in connection with their proposed Halifax & Southwestern road. The latter is to run between Halifax and Barrington, N. S., and 51 miles between Barrington and Yarmouth are already completed. The Central Ry. has been sold several times and was originally chartered under the name of the Nictaux & Atlantic, with a cash subsidy and 150,000 acres of land additional. It is reported that the net earnings were $15,365 for the year ending June 30, 1901.

CHEAT RIVER & PITTSBURGH.—This company was chartered July 9, to build a steam railroad from a point opposite the mouth of Cheat River in Greene County, Pa., across said river, to a point where the line between the States of Pennsylvania and West Virginia crosses the river, 3½ miles. Wm. C. Weiderseim, of Philadelphia, is President. See also under Cheat Haven, July 11, p. 561.

CHEAT RIVER & WHEELING.—This company was chartered July 9, to build a steam railroad from a point where the line between West Virginia and Pennsylvania crosses Cheat River, to a point on the west bank of the Monongahela River in Greene County, 3½ miles. Chas. F. Seeger, of Philadelphia, is President.

CHICAGO & NORTH WESTERN.—Announcement is made that the Fremont, Elkhorn & Missouri Valley line from Verdigre to Niobrara, Neb., 11 miles, was opened for traffic on July 7.

CIMARRON & TAOS VALLEY.—Additional surveys by a large force are reported for this projected line in New Mexico and Arizona. Lines are now being run from Taos to Ojo Caliente, and from the latter point northwest through Arizona, with San Diego as the objective point. Final surveys between Maxwell City and Elizabethtown, N. Mex., 54 miles, were reported last May. The road was incorporated in November, 1901, with the intention of beginning grading this spring, but nothing has as yet been done, with the exception of the surveys referred to. (May 23, p. 385.)

CLEVELAND, ELYRIA & WESTERN (ELECTRIC).—The Norwalk extension of this line from Norwalk to Oberlin, Ohio, has been completed. The company now has about 100 miles of electric line in operation from Cleveland to Berea, Elyria and Oberlin, with branches.

CUBA ROADS (ELECTRIC).—Franchises for lines in the city of Havana, Cuba, have been granted to W. H. Park and H. G. Hamilton, of Youngstown, Ohio. It is estimated that the value of the concession is $25,000,000. Debott, Trimble & Co., of Chicago; G. F. Penhale & Co., of New York; H. W. McDonald & Co., of Chicago, and W. J. Hayes & Sons, of Cleveland, are said to be associated with Messrs. Park and Hamilton.

DALLAS, CLEBURNE & SOUTHWESTERN.—Contract for this proposed line between Cleburne and Dallas, Texas, 50 miles, is reported let to Daugherty & Davis, of Joplin, Mo. (June 27, p. 519.)

GREAT NORTHERN.—It is said that double tracking will be completed on the proposed second track between Seattle and Everett, preparations for which are now being made, by fall. The road will then have 33 miles of double track entering Seattle. Stone is now being brought from the Index quarries at the rate of 30 or 40 carloads a day, for use on the grade.

HANNIBAL & CONNECTING.—This company was recently incorporated in Missouri to build a railroad eight miles long from Ilasco Landing to Hannibal, Mo. J. R. Maxwell and Alfonso de Navarro and others, of New York, are interested.

HUTCHINSON & ARKANSAS.—This company was chartered in Kansas July 2, to build from Hutchinson to Ketchi, in Sedgwick County, a distance of 70 miles. The capital is $80,000, and State Senator Frank Vincent is President.

ILLINOIS CENTRAL.—It is said that a line is to be built from Brookhaven to Monticello, in Lawrence County, Miss., a distance of about 30 miles. A logging road is now in operation over a considerable portion of the distance, so not much clearing or grading will be required. The logging road in question has been purchased, and it is said that the new building will begin in August.

The contract for double tracking 63 miles of line from Brookhaven, Miss., to Hammond, La., has been let to C. D. Smith & Co., of Memphis, Tenn., who have just completed a section running north 40 miles from Brookhaven. The completion of this section will probably finish the double tracking between Chicago and New Orleans. (April 18, p. 296.)

INDIANAPOLIS & EASTERN.—This is the corporate name of the consolidation of the Indianapolis & Greenfield Rapid Transit and the Indianapolis & Eastern Traction companies. Articles of incorporation were filed recently in Indiana for the consolidation, with a capital stock of $1,200,000, and by the terms of the merger, $1,000,000 of the capital is to be common stock and $200,000 preferred. The Indianapolis & Greenfield Rapid Transit owns about 17½ miles of track between Greenfield and Irvington, Ind. The Indianapolis & Eastern Traction Line is being operated between Greenfield and Knightstown, Ind., 14 miles, and is projected beyond.

JAMES RIVER.—Track laying is reported begun on this new line, which was organized at Portsmouth, Va., June 21, to operate under the charter previously obtained, and build from Portsmouth to the West Virginia line. John L. Watson, Portsmouth, Va., is interested. (July 4, p. 543.)

JONESBORO, LAKE CITY & EASTERN.—Grading is reported begun on this projected line in Arkansas, to run from Manila to Blytheville, 15 miles. J. E. Jones, of Jonesboro, is President, and M. E. Brooks is Engineer in charge of construction. (June 20, p. 486.)

KLONDIKE MINES.—According to most recent advices, 15 or 16 miles of this new line from Dawson, Alaska, to Grand Forks and the Upper Stewart will be built this year. The total distance projected is about 80 miles, and contract for this has been let to M. J. Heney. The estimated cost of the entire line is $2,500,000.

LAKE ERIE & DETROIT RIVER.—This company is said to have entered into an agreement with the Pere Marquette for the operation of cars on both lines. According to the plan, a car ferry will be established between Port Huron, Mich., and Sarnia, so that loaded cars may be sent from northern Michigan to Port Huron, across by ferry to Sarnia, and then over the Lake Erie & Detroit River to Stanley or Rondeau, and thence by car ferry to Conneaut, Ohio.

LOUISIANA ROADS.—An officer writes in regard to the projected line from Donaldsonville, La., to Napoleonville, that a name for the company has not yet been selected. The motive power will be steam, with oil-burning compound engines. Preliminary surveys have been completed and location of line made, and it is thought that

contracts for grading and track laying will be let inside of three weeks, none having been let as yet. The culverts along the line will be of vitrified pipes, with masonry ends. The character of the work is entirely over flat cultivated cane fields, and very light grading will be required except at the junction and crossing of the Texas & Pacific. One steel drawbridge with clear open channel at least 80 ft. wide, will be required to cross Bayou Lafourche. The company requires one combination oil burning locomotive weighing 108,000 lbs., with tractive capacity of 2,475 tons on the level track. Further specifications include six drivers, with 54-in. centers, and Vanderbilt fire-box. It is also proposed to operate six "steamers," which are individually driven steam passenger coaches, equipped with oil burning compound engines. It is intended to have these capable of seating 34 passengers, and running 25 miles an hour over level track. Among other requirements for which orders have not been placed are 2,000 tons of 65-lb. steel rails, with joints, etc.; also a number of split spring switches, etc.

Mexican Central.—In regard to reports of surveys between San Juan and Cerralvo, an officer writes that those which have been made are only preliminary, and no steps have as yet been taken in regard to a permanent location or to building.

Minneapolis, St. Paul & Sault Ste. Marie.—Track laying is reported begun at Braddock, N. Dak., on the proposed extension to Bismarck, 40 miles distant, for which contract was let to Halverson, Richards & Co., of Minneapolis. The work consists, in the main, of repairing an old grade made 13 years ago. (May 30, p. 404.)

Mount Vernon, Mount Gilead & Western (Electric).—Rights of way are reported secured for an electric road to run from Mount Vernon, to Marion, Ohio, 43 miles. It is said that grading will begin soon, and entrance to Mt. Vernon will be made over the tracks of the existing company, which will probably be consolidated with the new line. Hon. U. G. Denman, of Marion, Ohio, is interested.

New Jersey & Pennsylvania Traction.—To simplify the management of what is known as the Johnson Trolley Syndicate, the Trenton, Lawrenceville & Princeton, the Yardley, Morrisville & Trenton and the Newton, Yardley and Princeton Street railroads were consolidated with the above company. The lines in question are all in the vicinity of Trenton, N. J. The capital stock is to be raised from $1,000,000 to $3,000,000.

Norfolk, Portsmouth & Newport News.—This company has recorded two mortgages, one to the North American Trust Co., New York, trustee, for $4,000,000, and the other to the Richmond Trust & Safe Deposit Co., for $2,000,000. Both of these mortgages cover 40-year, 5 per cent. bonds, and the first named is designated as a first mortgage, and the second named as a first income mortgage. The Norfolk, Portsmouth & Newport News Co. is an amalgamation of traction lines in the vicinity of Norfolk, Va., embracing a system of over 120 miles, besides ferry lines, electric lighting plants and three seaside resorts. (June 6, p. 422.)

Northern Pacific.—Nearly $500,000 has been authorized on the Spokane or Idaho Division alone for track and other improvements, since Jan. 1. Work is now well under way on this betterment of the line. It is proposed to build several long sidings between Spokane and Ellensburg, to relieve congestion of traffic during the transportation of grain. These sidings will be about 3,000 ft. long. The improvements will also include the filling in of 15 bridges and trestles on the Washington Central, and of five on the Palouse branch.

Pacific Electric.—The 23-mile line between Los Angeles and Long Beach, Cal., was opened for business on July 4. This line is built with heavy rails and equipped with high-speed cars, grading and curvature having been reduced to a minimum. (Feb. 28, p. 154.)

Pennsylvania.—President Cassatt is quoted as saying that the company had made plans to spend $100,000,000 on improvements and extensions within the next three years, including the North River tunnel, the cost of which is estimated at about half this sum.

The Pennsylvania, New Jersey & New York has filed a map in the office of Secretary of the State of New Jersey showing the location of the Hudson River tunnel and its approaches, beginning in the Hackensack meadows north and east of Harrison. The line curves thence north for 4,000 ft., running straight across the Hackensack River, and passing south of what is known as Snake Hill. About a mile beyond this point it again curves south to connect with the tunnel which will run under West Hoboken and Weehawken from the North River.

St. Louis & Northwestern.—It is said that permanent surveys are to be made soon for a line about 100 miles long from Brookfield, Mo., to a point on the Missouri, Kansas & Texas, by way of Armstrong, Columbia, Fulton and other towns. J. G. Gallemore, of Salisbury, Mo., is Secretary.

San Mateo Electric.—Work is reported in progress by 600 men and 250 teams grading this projected line in California. It is planned to run fast cars, paralleling the Southern Pacific between San Francisco and San Mateo, 21 miles. The embankment is being capped with broken rock to permit a substantial ballast for heavy rails. Some of these are 70-lb., others 72-lbs., and the balance 76-lb. The difference is made necessary on account of the short supply of any one weight.

Santa Clara Electric.—The Board of Supervisors has granted a petition for a bid on an electric railroad franchise, for a line between the western end of San Jose, Cal., and Saratoga, with an extension to Los Gatos. The road will be permitted to carry freight as well as passengers, and will be about 12 miles long.

Smyrna & Delaware Bay.—This property, formerly a portion of the Philadelphia, Wilmington & Baltimore, was sold at sheriff's sale, July 7, to J. H. Dyer, of Norristown, Pa., for $15,150. The Pennsylvania R. R. stopped bidding at $15,000. The Smyrna & Delaware Bay runs from Massey's to Bombay Hook, in Delaware Bay, 16 miles.

Southern Pacific.—An officer sends information about the Caney Valley Branch, which is to be built from Van Vleck to Bay City, Texas, 17 miles; that surveys have been completed; contracts are let and work is now in progress by S. A. Robertson, of Orange, Texas, who is contractor for grading and trestles. Seven miles of grade, and two miles of track were completed on June 21. There are no important towns on the line, which is light valley work, with easy curves, and grades of 10.6 ft. per mile, maximum. There are no steel bridges or important trestles, and required track materials have been secured. Ground was broken for this extension May 23. (June 6, p. 422.)

Bids have been asked on the remainder of the grading for the Ogden-Lucin cut-off. The work includes a stretch about four miles long, with masonry. A tract of 12 acres of land lying between San Jose and Polhemus, Cal., has recently been sold to the company for about $45,000, and it is expected that a cut-off will be built to the property to remove a curve, and that yards and warehouses may also be put in.

Sumpter Valley.—It is said that no building will be done this year, although surveys for an extension west from Whitney, Ore., were made last May.

Syracuse-South Bay (Electric.)—It is said that J. G. White & Co., of New York, have agreed to furnish the necessary funds for building this proposed trolley line, which will be about 15 miles long, between the points named in New York.

Temosachic-Minaca.—An officer writes in regard to press reports that a line is to be built between the points named, by a syndicate headed by Enrique C. Creel, that the project has not as yet materialized.

Tennessee Central.—It is said that this company will extend its tracks to new coal properties of the Fentress Coal & Coke Co. in Fentress County, Tenn., seven miles.

Tennessee Roads.—A company is reported organized by Col. L. A. Gratz and others, of Louisville, Ky., in connection with the Blue Gem Coal Co., to build a coal railroad from Jellico, Tenn., to the mines of the Blue Gem Co. It is said that the line will later on be extended to coal lands on Crouch's Creek. A link a mile and a half long will be built between this extension and the Knoxville, La Follette & Jellico.

Texas & Louisiana.—This company is said to have amended its charter to provide for an extension from Windom to Newton, Texas, a distance of 75 miles. E. A. Frost, Lufkin, Texas, is General Manager.

Toledo, Saginaw & Muskegon (Grand Trunk).—It is said that this proprietary line of the Grand Trunk, running between Muskegon, Mich., and Owosso Junction, 116 miles, will be straightened during the coming year. The work includes a number of cuts and fills, and it is possible that short extensions will also be built in connection with it. Work on straightening the roadbed has been begun at Sparta.

Ulster & Delaware.—Application has been made to the New York Stock Exchange to list $600,000 4 per cent. refunding mortgage 50-year bonds, and $1,900,000 capital stock.

Vancouver & Lulu Island (British Columbia).—The first train over this line, 14 miles long, which connects Vancouver with the headquarters of the salmon canning industry, reached Vancouver on July 2. H. Abbott, of Vancouver, is President.

Vera Cruz & Pacific.—On July 1, connection was established between Perez and Santa Lucretia, Mexico, 90 miles. Connection with the Tehuantepec R. R. is established at Santa Lucretia, forming a through line from Cordova to Santa Lucretia, 214 miles, and a through connection from the last named point to the Pacific. The Tehuantepec road crosses the Isthmus from Coatzacoalcos.

Vinton, Belle Plaine & Independence Interurban.—An officer writes that the length of this line between the points named will be 60 miles, and that surveys are being made and the prospects of building are good. It is thought that the road will be running within a year, and that contracts will be let in about 60 days. The character of the work is light but grades and curves cannot be stated at the present time, as surveys are not yet sufficiently advanced. Arthur R. Jones, The Rookery, Chicago, is President. A Chief Engineer has not yet been selected. (June 27, p. 520.)

Washington Roads.—It is said that deeds for all the right of way, except for one section for the proposed logging road of the Chehalis County Logging & Timber Co., have been secured, and that suit has been commenced to condemn right of way over this stretch, which is known as the Haye property. Preliminary surveys are also reported for another logging road in the vicinity of Montesano, Wash., to open up property owned by the Frank H. Lamb Timber Co., which operates a camp on Black Creek, a branch of the Wonooche, four miles from Montesano. Surveys are now being made.

West Pittsburgh Connecting.—Charter was granted this company, incorporated April 29, on July 11. The company is composed almost wholly of Pittsburgh parties who are interested in the development of the new industry of West Pittsburgh, and propose to build a railroad from Newcastle, Lawrence County, Pa., to Chewton, nine miles. The project includes a bridge with a span of 900 ft. over the Beaver River. Henry Evans, of Pittsburgh, is President. (May 9, p. 354.)

GENERAL RAILROAD NEWS.

Arkansas & Choctaw.—The St. Louis & San Francisco took control of this property on July 10. At present 95 miles of the road are in operation, and it is projected from Hope, Ark., to Ardmore, Ind. T., a total of 223 miles, the majority of which will probably be ready for operation some time this year. There are two points where junction is made with the St. Louis & San Francisco.

Atchison, Topeka & Santa Fe.—Announcement of the conclusion of the purchase of the California Eastern by this company is now made. The California Eastern operates 45 miles of line between Goff's and Ivanpah, Cal., and has previously been owned by John R. Woodbury, of New York, and R. Seibert, of Los Angeles. It is thought that the Oregon Short Line will be built to a connection with this line at Ivanpah, and will obtain entrance into Los Angeles by traffic agreement with the Santa Fe.

Atlantic Coast Line.—First consolidated mortgage 50-year 4 per cent. gold bonds, dated July 1, 1902, are offered to the extent of $10,500,000, by Brown Bros. & Co., Hallgarten & Co., and Vermilye & Co., for 100½ and accrued interest. The bonds are a first lien upon about 570 miles of line, and are secured by a mortgage to the United States Trust Co., trustee. They are limited to $20,000 per mile of railroad, including underlying divisional liens. The total amount of the mortgage is $80,000,000, of which $31,034,000 have been issued; $35,102,000 are reserved to take up underlying liens, and $13,864,000 reserved for acquisition, etc. The *Commercial and Financial Chronicle* lists the following obligations as included in the purposes of the issue: $12,451,000 Savannah, Florida & Western 4 per cent. consolidated mortgage bonds, due April 1, 1952; $4,375,000 Wilmington & Weldon 7 per cent. certificates of indebtedness; $570,000 Wilmington & Weldon irredeemable 6 per cent. special trust certificates of indebtedness, and $3,000,000 Atlantic Coast Line (old company) 4 per cent. certificates of indebtedness, of which $3,000,000 are irredeemable; also $10,638,000 for the purchase price of securities, terminals, etc., acquired from the Plant Investment Co. under agreement of May 15, 1902. The new Atlantic Coast Line Co. is a consolidation of the Atlantic Coast Line R. R. Co. with the Savannah, Florida & Western, and it has $42,000,000 capital.

Baltimore & Southern.—Negotiations are now in progress for the purchase of the franchises and property of this company, more commonly known as the Drum Point R. R. A bill was introduced into the Maryland Legislature last March for the transfer of the charter and franchises of the road to other hands, providing the present owners did not build 20 miles before Sept. 1, 1902. Drum Point is 18 miles below Baltimore, and the Fuller Syndicate, in the interest of the Goulds, is talked of as having the property under consideration.

California Pacific (Electric).—Part of an issue of bonds secured by mortgage on the new electric line building between Los Angeles, Cal., and San Pedro, 20 miles, are offered by Louis Blankenhorn, of Los Angeles, at 102 and interest. The bonds are first mortgage gold 5's, due in 1941, without optional redemption, and the principal and interest is guaranteed by the Los Angeles Traction Co. The Title, Insurance & Trust Co., of Los Angeles, is trustee.

Canadian Eastern.—It is reported that this road, controlled by Alexander Gibson & Co., and operated by them, has been acquired by the Canadian Pacific. It runs from Fredericton, N. B., to Chatham, 125 miles, and makes connection with both the Canadian Pacific and the Intercolonial. Sir Thomas Shaughnessy is quoted as saying that he will neither confirm nor deny the report.

Chesapeake & Nashville.—The Hartsville Branch of this line, running between Hartsville Junction and Hartsville, Tenn., 12 miles, was sold July 7 for unpaid taxes, and was purchased by the State. When the road was purchased by the present owners, the Trousedale County Court released it from taxation for 15 years, but later on reversed this judgment and demanded back taxes. These the road declined to pay.

Chicago, Rock Island & Pacific.—Control of the St. Louis, Kansas City & Colorado, and of the Gasconade Construction Co., which is building the western extension of the line, passed on July 8 to the Chicago, Rock Island & Pacific. An increase of capital stock was authorized last June by the latter, and $2,000,000 of this was applied to the purchase. The St. Louis, Kansas City & Colorado is now in operation between St. Louis and Belle, Mo., 105 miles, and an extension is being built west from Belle. W. B. Leeds was elected President in place of John Scullin, resigned, and six Rock Island directors were chosen in place of six of the old board. David R. Francis, John Scullin and Geo. R. Sands, of the old board, were retained. (July 11, p. 562.)

Fair Haven & Westville (Electric).—In accordance with a vote of the stockholders, taken last May, the capital stock will be increased in the sum of $633,000 for betterments to the line, and the new stock will be issued on Oct. 1 to stockholders of record, at the rate of one share of new stock for every six shares held by them on Sept. 1. The present stock of the company, including that of the Winchester Avenue system, now almost wholly owned, is $3,800,000, and the present issue is only half that authorized by the stockholders last spring. When the remainder is issued, the total authorized capital of the line will be in existence. (May 16, p. 372.)

Illinois Central.—Notice is given that a special meeting of stockholders will be held in Chicago on Aug. 29 to consider the proposition of increasing the capital stock from 792,000 shares of $100 each, to 950,400 shares, thus making the total capital stock $95,040,000. According to the plan each shareholder of record Sept. 19, 1902, shall have the privilege of subscribing at par, at the rate of one share of new stock for every five shares of stock held by him. The new shares but not the fractions of shares, shall be entitled to participate in all dividends which may be declared payable after Jan. 7, 1903.

International & Great Northern.—Report on the application of this company for authority to issue $300,000 of bonds on the second 15 miles of road north of Waco, Texas, was submitted July 1 by Engineer Thompson, of the State Railroad Commission. The recommendation was favorable but the Commission has not yet taken action.

Oakland Transit Consolidated.—This company has filed a trust deed with the Union Trust Co., of San Francisco, to secure a bonded indebtedness of $6,500,000, of which $3,000,000 is to be devoted to improving and extending the company's system, including two branches and a power house.

Richmond & Danville.—Notice is given that 56 equipment mortgage bonds have been drawn for the sinking fund, and that interest on these bonds ceases Sept. 1, in accordance with the terms of the mortgage.

St. Louis & Suburban Street.—At a meeting of the stockholders on July 1, a new bond issue of $7,500,000 is to be used for improvements, additions, etc., and a remainder reserved to retire bonds of the subsidiary companies comprising the system which, according to report, are to be absorbed. These companies are three in number and have a total mileage of 37.

Staten Island Electric.—Notice is given to the holders of the bonds and stock of this company, of the New York & Staten Island Electric and allied corporations, and of receipts of Messrs. Thomas, Rogers & Ryan, committee of Richmond Borough Company, that a majority in value of the mortgage bonds of the Staten Island Electric R. R., and of the receipts going to the delivery of the Richmond Borough Company stock, and of the bonds and stock of the New Jersey & Staten Island Ferry Co., etc., having been deposited under the terms of the agreement, lodged with the Guaranty Trust Co., of New York, under date of April 1, 1902, the reorganization plan is declared operative and the time for the deposit of securities, under said plan and agreement is extended to July 31, 1902. The plan includes the organization of the $2,500,000 first and collateral and trust mortgage, and a $3,000,000 issue of capital stock. For further particulars see our issue of May 30, p. 404.

Western Ohio (Electric).—An interest in this company has been purchased by F. L. Fuller & Co., and M. J. Mandelbaum & Co. The Western Ohio is a portion of the line which is to establish through car service next year between Toledo and Cincinnati, Ohio, a distance of 204 miles, in connection with the Cincinnati, Dayton & Toledo Traction Co., the Dayton & Troy Electric and the Toledo, Bowling Green & Southern.

Worcester & Connecticut Eastern.—Organization is in progress of the Worcester & Webster; Webster & Dudley; Worcester & Connecticut Eastern; Thomson Tramway; Peoples' Tramway, and Danielson & Norwich Street lines as a consolidation under the name of the above. It will be controlled by the Sanderson-Porter Co., of New York, and will operate about 60 miles of electric lines in Massachusetts and Connecticut.